NOAA *Okeanos Explorer* Program

MAPPING DATA REPORT

CRUISE EX1203

Exploration Mapping: Gulf of Mexico

May 5 – May 23, 2012
Galveston, TX to Norfolk, VA

Report Contributors:
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8 June, 2012

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1. Introduction

The *Okeanos Explorer* Program

Commissioned in August 2008, the NOAA Ship *Okeanos Explorer* is the nation's only federal vessel dedicated to ocean exploration. With 95% of the world's oceans left unexplored, the ship's combination of scientific and technological tools uniquely positions it to systematically explore new areas of our largely unknown ocean. These exploration cruises are explicitly designed to generate hypotheses and lead to further investigations by the wider scientific community.

Using a high-resolution multibeam sonar with water column capabilities, a deep water remotely operated vehicle, and telepresence technology, *Okeanos Explorer* provides NOAA the ability to foster scientific discoveries by identifying new targets in real time, diving on those targets shortly after initial detection, and then sending this information back to shore for immediate near-real-time collaboration with scientists and experts at Exploration Command Centers around the world. The subsequent transparent and rapid dissemination of information-rich products to the scientific community ensures that discoveries are immediately available to experts in relevant disciplines for research and analysis

Through the *Okeanos Explorer* Program, NOAA's Office of Ocean Exploration and Research (OER) provides the nation with unparalleled capacity to discover and investigate new oceanic regions and phenomena, conduct the basic research required to document discoveries, and seamlessly disseminate data and information-rich products to a multitude of users. The program strives to develop technological solutions and innovative applications to critical problems in undersea exploration and to provide resources for developing, testing, and transitioning solutions to meet these needs.

Okeanos Explorer Management – a unique partnership within NOAA

The *Okeanos Explorer* Program combines the capabilities of the NOAA Ship *Okeanos Explorer* with shore-based high speed networks and infrastructure for systematic telepresence-enabled exploration of the world ocean. The ship is operated, managed and maintained by NOAA's Office of Marine and Aviation Operations, which includes commissioned officers of the NOAA Corps and civilian wage mariners. OER owns and is responsible for operating and managing the cutting-edge ocean exploration systems on the vessel (ROV, mapping and telepresence) and ashore including Exploration Command Centers and terrestrial high speed networks. The ship and shore-based infrastructure combine to be the only federal program dedicated to systematic telepresence-enabled exploration of the planet's largely unknown ocean.

Table of Contents

2. Report Purpose

The purpose of this report is to briefly describe the mapping data collection and processing methods, and to report the major results of the cruise. For a detailed description of the *Okeanos Explorer* mapping capabilities, see Appendix B as well as the ship's readiness report, which can be obtained by contacting the ships Operations Officer (ops.explorer@noaa.gov).

This report focuses on exploration expedition EX1203 during which areas of Gulf of Mexico, Florida Escarpment, and South Atlantic Bight were mapped.

3. Cruise Objectives

The exploration area for this expedition was chosen based upon guidance from the OER / Ocean Exploration Advisory Working Group (OEAWG) workshop results (Atlantic Basin Workshop, 2011) that identified high priority target areas for exploration in the Gulf of Mexico (Fig. 1) and input received from participating scientists from the Bureau of Ocean Energy Management (BOEM, Bill Shedd), the United States Geological Survey (Laura Brothers), other NOAA line offices (National Ocean Service, Geo Olmi) and academic institutions including the University of New Hampshire (UNH, Larry Mayer and Tom Weber), Louisiana State University (LSU, Bob Carney), the University of North Carolina (UNC, Steve Ross and Michael Rhodes), Scott Harris (CoC) and Duke University (Cindy Vandover).

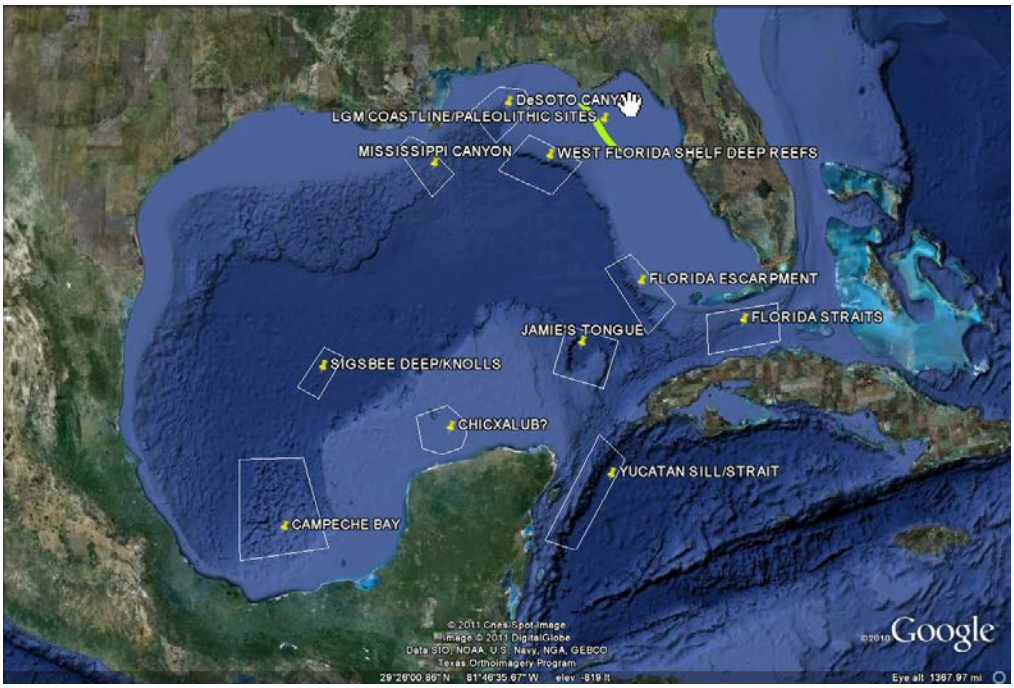

Figure 1: Priority exploration targets identified during Atlantic basin workshop held in May 2011. Image created in Google Earth.

Most of the sites in the southern part of the Gulf of Mexico (Fig. 1) were excluded from consideration for EX1203 as they are outside the US EEZ and the time frame for this cruise was considered too short to pursue any foreign clearances/ permits. Focusing on the Northern part of the Gulf, two exploration areas were chosen: the Mississippi Canyon and the Western Florida Shelf.

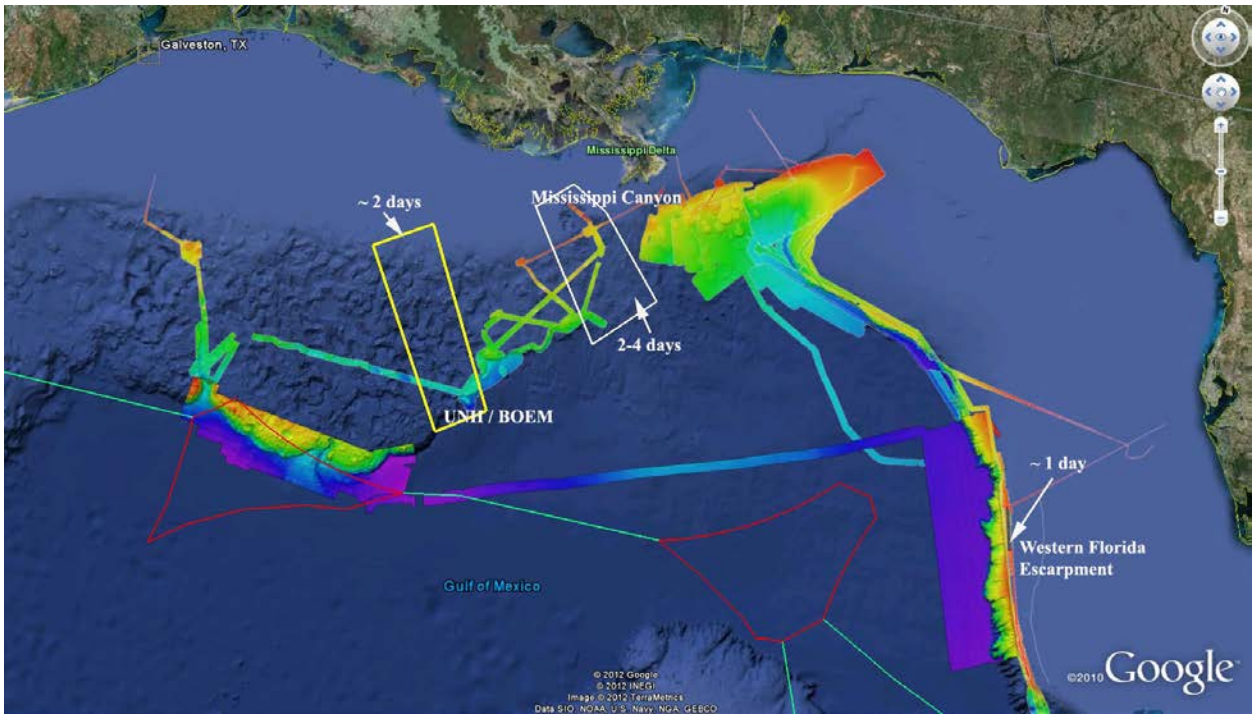

Figure 2a: Mapping priority areas for EX1203 along with expected time to be spent at each site in Gulf of Mexico. Shown is the previous mapping coverage in vicinity of work areas. Image created in Google Earth.

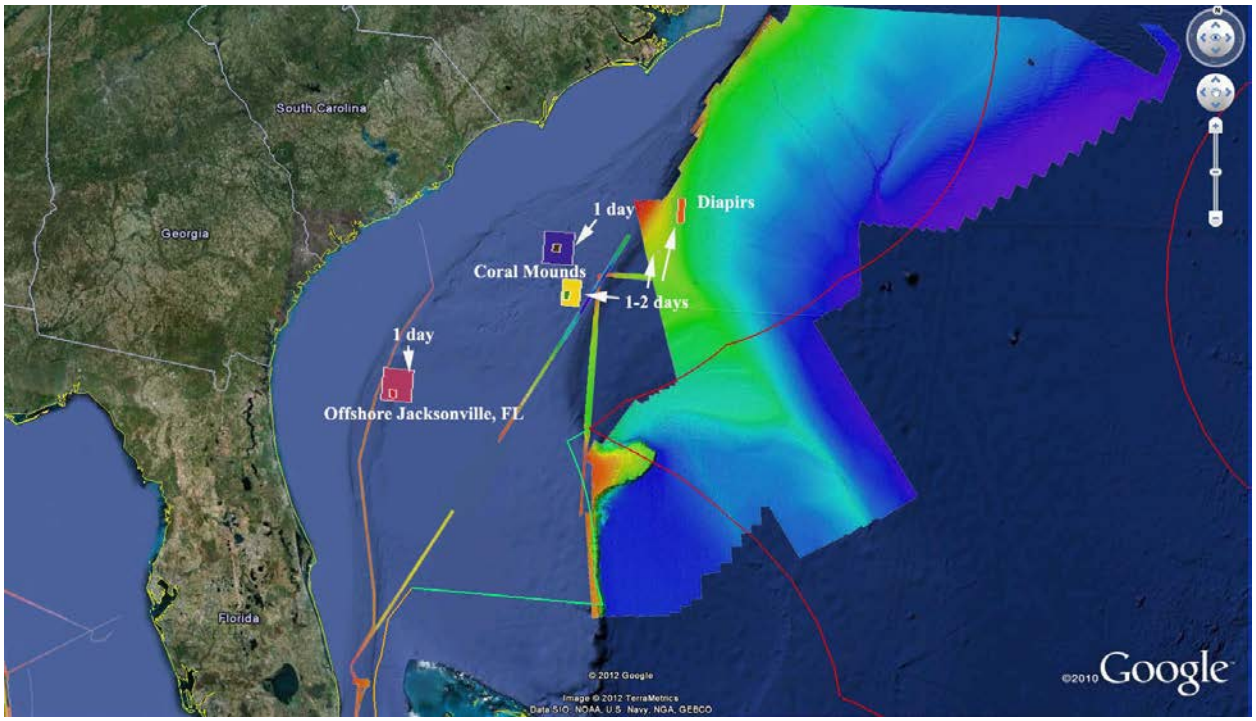

Figure 2b: Mapping priority areas for EX1203 along with expected time to be spent at each site in South Atlantic Bight. Shown is the previous mapping coverage in vicinity of work areas. Image created in Google Earth.

In summary the following were mission objectives for EX1203 (as per EX1203 project instructions, April 2, 2012):

a. Safe Transit from Galveston, TX to Norfolk, VA

The overall objective was data collection during a safe transit from Galveston, TX to Norfolk, VA. Continuous data collection (24 hours per day) occurred for the following data types: EM 302 multibeam bathymetry, bottom backscatter, and water column backscatter; EK 60 singlebeam water column; and Knudsen sub-bottom profiler data (collected daily from 0800-2000 local time).

b. Focused mapping during the transit

A relatively direct route from Galveston, TX to Norfolk, VA was approximately 1836 NM (3400 km), a time of approximately 9 days at transit speeds (~ 10-12 knots). The remaining approximately 10 days of the cruise were dedicated to focused mapping exploration operations. These operations included (please refer to Figure 2):

1. Completion of partial mapping in the BOEM/UNH box. Continue mapping coverage along the Florida Escarpment during transit adjacent to previous *Okeanos Explorer* coverage and completing Mapping Area along the Florida Escarpment (Figure 2a);

2. Water column and sub-bottom exploration mapping operations in the vicinity of the Blake Ridge Diapir in preparation for EX-12-05 Leg 1 (Figure 2b);

3. Mapping in focused previously unexplored areas offshore Jacksonville, FL over coral mounds (Figure 2b).

c. Science objectives

1. Continue to identify and explore the diversity of benthic habitats in the region (e.g. seeps, deep corals, canyons) by building on mapping coverage obtained during EX-11-05, EX-11-06, and EX-12-02 Legs 1, 2, and 3;

2. Possibly locate and characterize submerged cultural resources (SCR), e.g. shipwrecks (data will be used to assess their eligibility for the National Register of Historic Places) within EX-1203 operating area;

3. Utilize sub-bottom sonar to explore diapirs in the vicinity of Blake Ridge;

4. Conduct preliminary water column mapping (24-48 hrs) of Blake Ridge diapir system to test the hypothesis that there may be seepage and chemosynthetic communities along the 1000-m isobaths at the boundary of the methane hydrate stability zone using mapping and photo groundtruthing of selected targets.

d. *Telepresence* (VSAT 5 mb/sec ship to shore; T1 shore to ship)

1. Test and refine ship-to-shore communications and operations procedures;

2. Test and refine operating procedures and products;

3. Engage a broad spectrum of the scientific community and public in telepresence-based exploration, including during the cruise planning process; and

4. Expand use of the ‘Doctors-on-Call’ model.

e. Data Management

1. Provide a foundation of publicly accessible data and information products to spur further exploration, research, and management activities, as detailed in the 2012 post-cruise product list;

2. Provide daily, cumulative multibeam products to shore for operational decision making purposes, as detailed in the 2012 field products list;

3. Test data pipeline for daily transfer of raw sonar data to shore;

4. Test data pipeline of operationally required sub-bottom and EK 60 products to shore.

f. Outreach / Media

1. Port events in Norfolk, VA was conducted on 24 May 2012 that included ship's tours by NOAA leadership including Acting Deputy Administrator Eric Schwaab. Complete attendeed list is attached as Appendix D. After the tours, a brief discussion was held accompanied by a light lunch at the pier (hosted by VA Coastal Zone management Program and VA Sea Grant) to discuss OER partnership activities to map NE canyons.

2. Live interaction between the ship's control room and Silver Spring ECC on 22 May to host (Mr. Glen Paul, Media Officer in Corporate Communications for CSIRO, Australia, OER POC Fred Gorrell), and on 21 May to host Bill Gibson, a D.C.-based reporter for the Ft. Lauderdale Sun-Sentinel and the Orlando Sentinel (OER POC Fred Gorrell) and on 16 May to host OER intern Daniela Vitarelli (OER POC Joanne Flanders).

4. Participating Personnel

NAME	ROLE	AFFILIATION
CDR Robert Kamphaus	Commanding Officer	NOAA Corps
LT Megan Nadeau	Field Operations Officer	NOAA Corps
Mashkoor Malik	Expedition Coordinator / Mapping Team Lead	NOAA OER / ERT Inc.
Sean Denney	Mapping Watch Leader	NOAA OER / UCAR
Adam Argento	Mapping Watch Leader	NOAA PHB
Lillian Stuart	Mapping Watch Leader	NOAA OMAO
Daniel Whitesell	Mapping Watch Stander	NOAA OER / UCAR
Adrienne George	Mapping Watch Stander	NOAA OER / UCAR
Erin Hunter	Mapping Watch Stander	NOAA OER / UCAR
Charles Bendig	Mapping Watch Stander	NOAA OER / UCAR
Ashton Flinders	Mapping Watch Stander/ Leader	NOAA OER / UCAR

5. Summary of Major Findings

The expedition was divided into focused mapping areas while in transit from Galveston, TX to Norfolk, VA. The transit track line was deliberately laid adjacent to existing multibeam coverage.

a. BOEM / UNH Focused site (In vicinity of Green Canyon and Assumption Hill)

Assumption Hill / Green Canyon was the first focused site of the expedition where the EM302 and EK60 detected approximately 50 distinct water column targets which were presumed to be gas seeps rising from the seafloor. Dr. Carney (LSU) provided locations of the video observations of the seeps from 1980 to the present. Figure 3 shows a screen shot of

QPS/Fledermaus processed data of the northern area within this focused mapping site showing the bathymetry and the water column curtain obtained from the EK 60 sonar. The presumed seeps are highlighted by blue arrows.

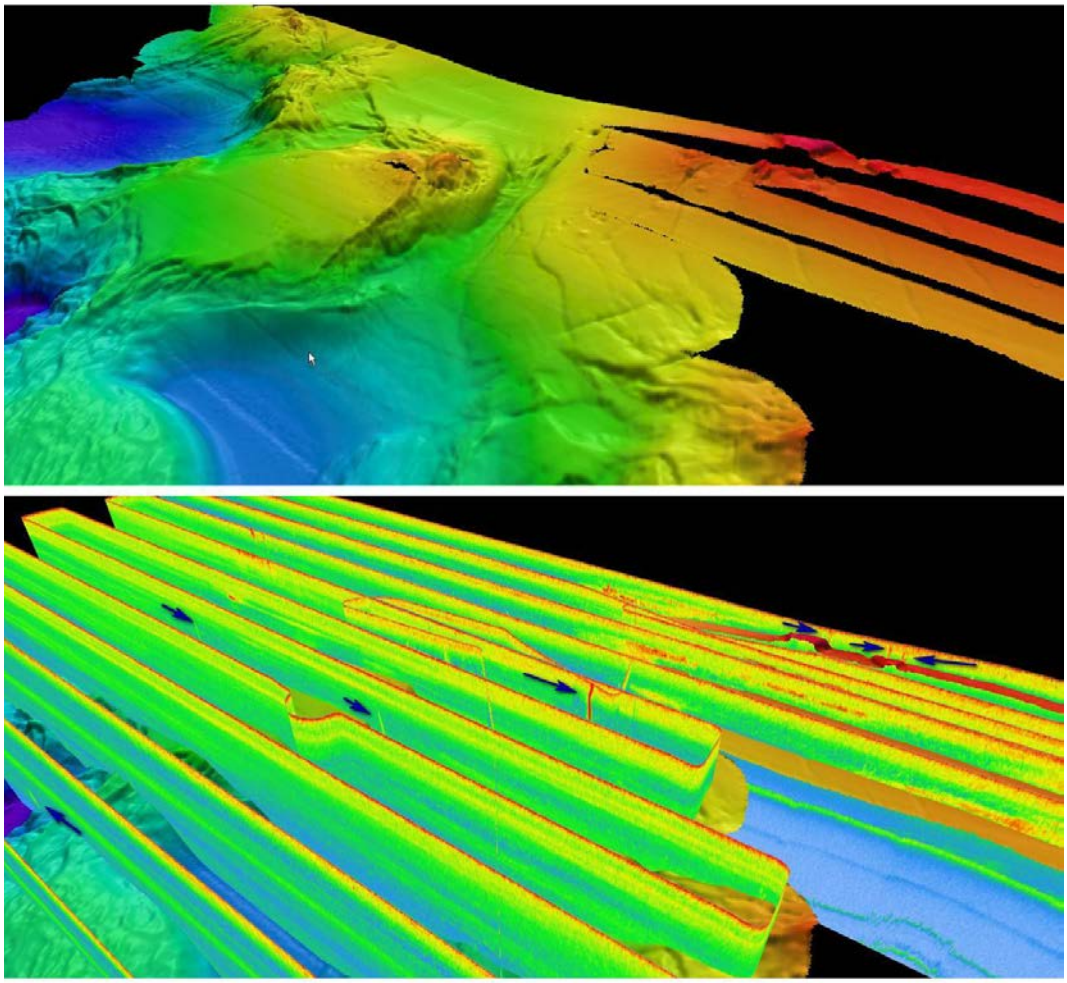

Figure 3: Top panel shows the bathymetry collected by EM 302. Lower panel shows the curtain of EK 60 single beam water column backscatter showing several presumed gaseous seeps (highlighted by blue arrows).

The following image (Figure 4) shows the location of the video observations of the seeps along with the seeps locations as detected by the EM302 and the EK60. The seep locations are overlaid on the bathymetric data that were collected during the current expedition.

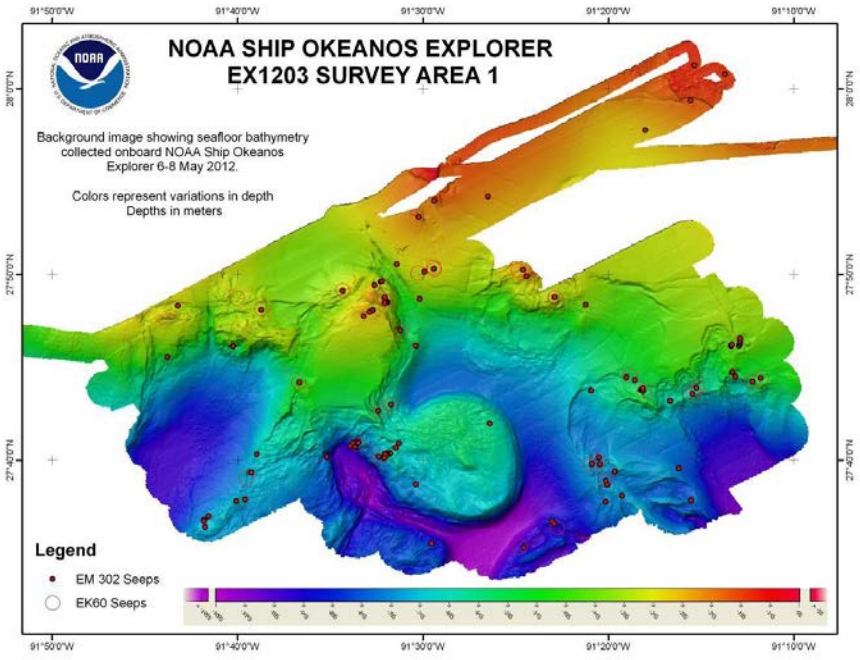

Figure 4: Compilation of presumed gaseous seeps detected by EM 302 and EK 60 water column backscatter data draped over the bathymetry collected by EM 302. The near circular feature in the middle of the Figure is Assumption Hill.

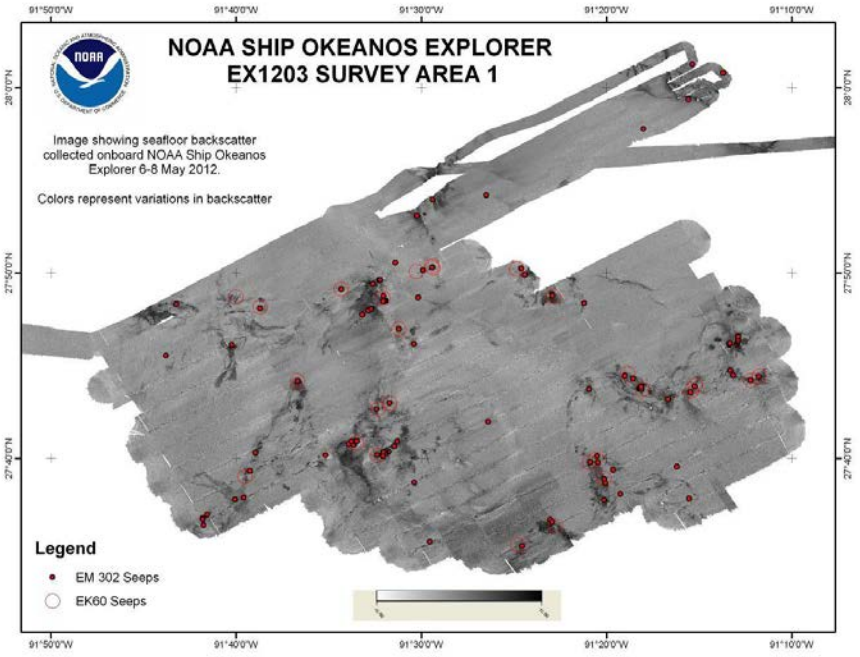

Figure 5: Compilation of presumed gaseous seeps detected by EM 302 and EK 60 water column backscatter data draped over the seafloor backscatter data collected by EM 302.

The locations of the seeps detected in this area are tabulated below:

Table 1: Seep locations detected by EM 302.

Longitude(W)	Latitude(N)	Depth	Longitude(W)	Latitude(N)	Depth
-91.553	27.79611	-76.1	-91.258	27.72639	-628.37
-91.259	27.63055	-822.61	-91.278	27.71992	-661.22
-91.49	27.83852	-281.99	-91.504	27.88504	-184.22
-91.49	27.83849	-308.07	-91.228	28.01329	-132.13
-92.174	27.81228	-308.96	-91.26	27.98956	-163.56
-92.174	27.81138	-302.54	-91.572	27.81889	-356.94
-92.153	27.80588	-246.09	-91.076	27.95412	-195.07
-91.256	28.02112	-130.41	-91.076	27.95405	-193.59
-91.49	27.89958	-180.3	-91.064	27.95508	-198.88
-91.73	27.75915	-516.93	-91.52	27.7833	-519.86
-91.442	27.90349	-202.81	-91.611	27.73644	-486
-91.645	27.80155	-368.22	-91.649	27.67198	-703.8
-91.3	27.96291	-267.84	-91.382	27.81312	-319.05
-91.523	27.84253	-370.67	-91.31	27.73868	-533.2
-91.721	27.80529	-337.12	-91.317	27.74122	-580.83
-91.503	27.81134	-465.32	-91.349	27.72914	-644.33
-91.671	27.76906	-562.5	-91.492	27.59195	-894.43
-91.384	27.61177	-889.81	-91.348	27.66338	-792.17
-91.382	27.60975	-903.83	-91.341	27.66321	-779.86
-91.27	27.6595	-825.73	-91.342	27.66903	-806.44
-91.321	27.63451	-795.76	-91.204	27.7372	-544.53
-91.409	27.58827	-945.83	-91.196	27.74036	-540.38
-91.336	27.62947	-807.76	-91.335	27.64816	-783.99
-91.44	27.69987	-617.66	-91.334	27.64449	-802.4
-91.506	27.64479	-792.15	-91.328	27.65675	-798.34
-91.304	27.72961	-526.15	-91.41	27.83758	-265.66
-91.303	27.72949	-555.15	-91.407	27.83175	-221.22
-91.303	27.72966	-557.43	-91.507	27.76971	-555.39
-91.302	27.72878	-560.86	-91.696	27.61311	-767.9
-91.302	27.73114	-511.37	-91.697	27.61305	-773.67
-91.223	27.76914	-450.87	-91.696	27.60691	-765.8
-91.223	27.77028	-420.52	-91.697	27.61238	-783.18
-91.222	27.77038	-429.12	-91.693	27.61622	-748.38
-91.216	27.76944	-374	-91.668	27.62975	-696.33
-91.215	27.77117	-433.77	-91.66	27.63128	-775.43
-91.215	27.77214	-440.44	-91.586	27.6698	-860.6
-91.215	27.77406	-421.49	-91.565	27.67957	-910.74
-91.215	27.77616	-435.75	-91.561	27.67891	-885.48

-91.219	27.74156	-540.39	-91.563	27.68202	-841.32
-91.222	27.74594	-524.09	-91.559	27.68114	-839.26
-91.254	27.73152	-630.43	-91.559	27.68228	-839.18
-91.558	27.68219	-835.3	-91.534	27.81282	-341.05
-91.522	27.68165	-663.48	-91.532	27.80856	-107.1
-91.525	27.67742	-698.24	-91.533	27.8085	-102.67
-91.53	27.67271	-694.45	-91.533	27.80835	-104.36
-91.532	27.67291	-717.59	-91.534	27.80821	-85.98
-91.532	27.67116	-715.59	-91.534	27.80799	-80.02
-91.533	27.6706	-707.93	-91.534	27.80794	-80.99
-91.534	27.67216	-721.37	-91.545	27.80128	-70.12
-91.534	27.67186	-725.23	-91.545	27.80105	-71.49
-91.535	27.66873	-733.02	-91.546	27.80092	-79.87
-91.539	27.66965	-783.35	-91.548	27.79957	-67.29
-91.54	27.66987	-800.56	-91.499	27.83598	-347.53
-91.654	27.65567	-772.95	-91.353	27.80618	-435.62
-91.544	27.82379	-305.32	-91.529	27.71656	-641.32
-91.538	27.82711	-365.38	-91.54	27.71119	-609.43
-91.537	27.82729	-365.34			

Table 2: Seep Locations detected by EK60

Longitude (W)	**Latitude (N)**	**Depth**
-91.667	27.81214	-343.33
-91.645	27.80276	-355.29
-91.572	27.81901	-331.37
-91.491	27.83987	-294.28
-91.612	27.73659	-474.92
-91.52	27.78319	-501.24
-91.414	27.83726	-251.22
-91.381	27.81256	-321.8
-91.529	27.71663	-625.65
-91.539	27.71137	-593.35
-91.659	27.65041	-744.08
-91.559	27.68077	-797.92
-91.54	27.66957	-765.62
-91.314	27.74302	-558.66
-91.301	27.72877	-558.66
-91.254	27.73243	-617.28
-91.343	27.66615	-813.47
-91.349	27.6629	-779.97

-91.204	27.73689	-520.38
-91.196	27.74088	-519.18
-91.336	27.64887	-789.54
-91.413	27.58896	-949.84
-91.379	27.60601	-947.45
-91.257	27.7276	-648.38
-91.535	27.81039	-301.46
-91.49	27.83813	-299.07
-91.505	27.83468	-334.96

Ship observed an unknown sheen on 7 May which was reported to NRC (Incident # 1010808) http://www.nrc.uscg.mil/reports/rwservlet?standard_web+inc_seq=1010808

b. Mississippi Canyon

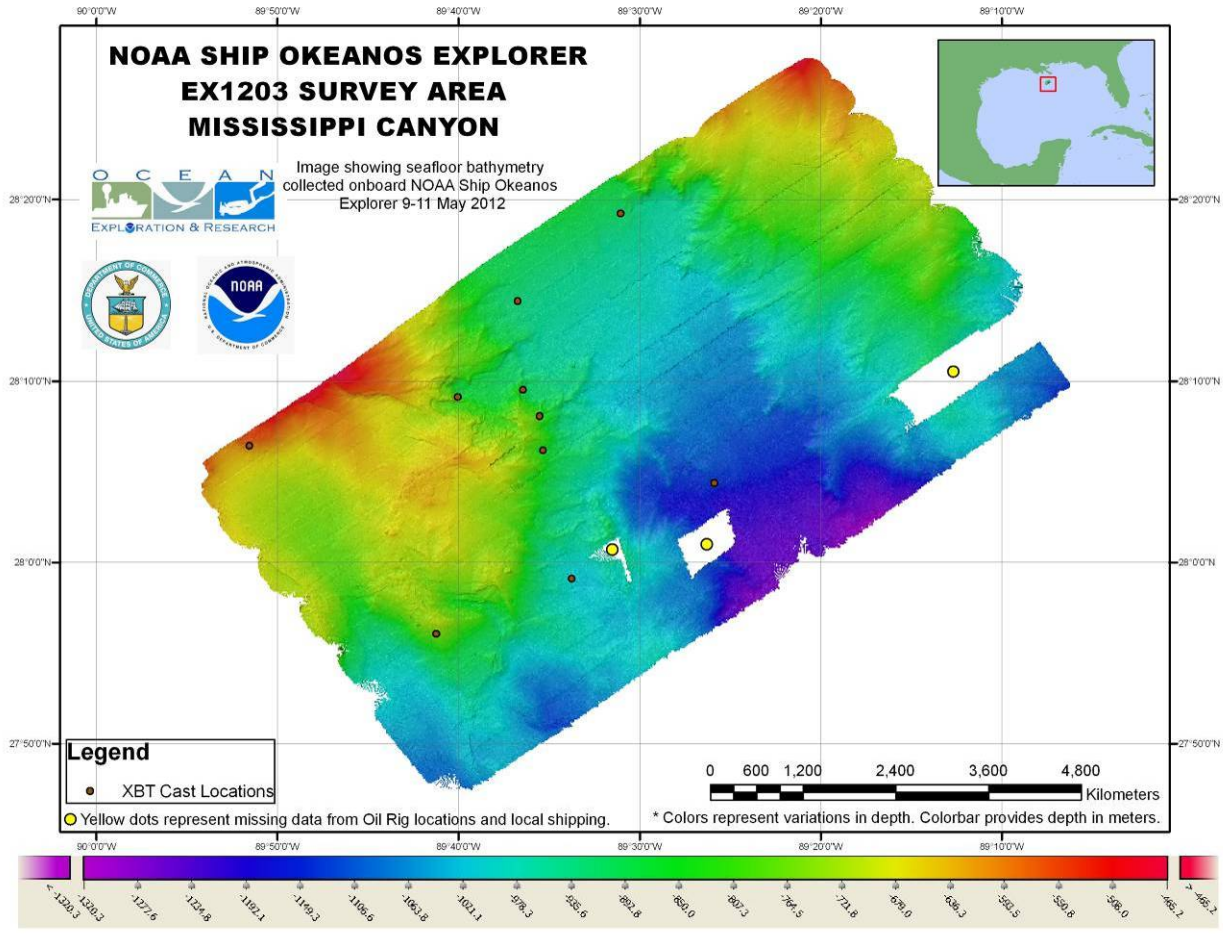

Figure 6: Bathymetry data acquired in the Mississippi canyon priority mapping box overlaid with the XBT cast locations and the oil rig locations which hindered collection of the data in vicinity of these oil rigs.

c. Western Florida Escarpment focused mapping area

The mapping area was identified during 2011 by Steve Ross (UNC). Over the previous five cruises during 2011 and 2012, the transit mapping track line to and from the Gulf of Mexico from the East coast was intentionally planned to overlap the previous data. Over these five cruises, the whole of the area identified by the scientists has been mapped (Figure 7).

Several interesting features were observed in the vicinity of the priority area. A few of the examples are provided in Figures 8.

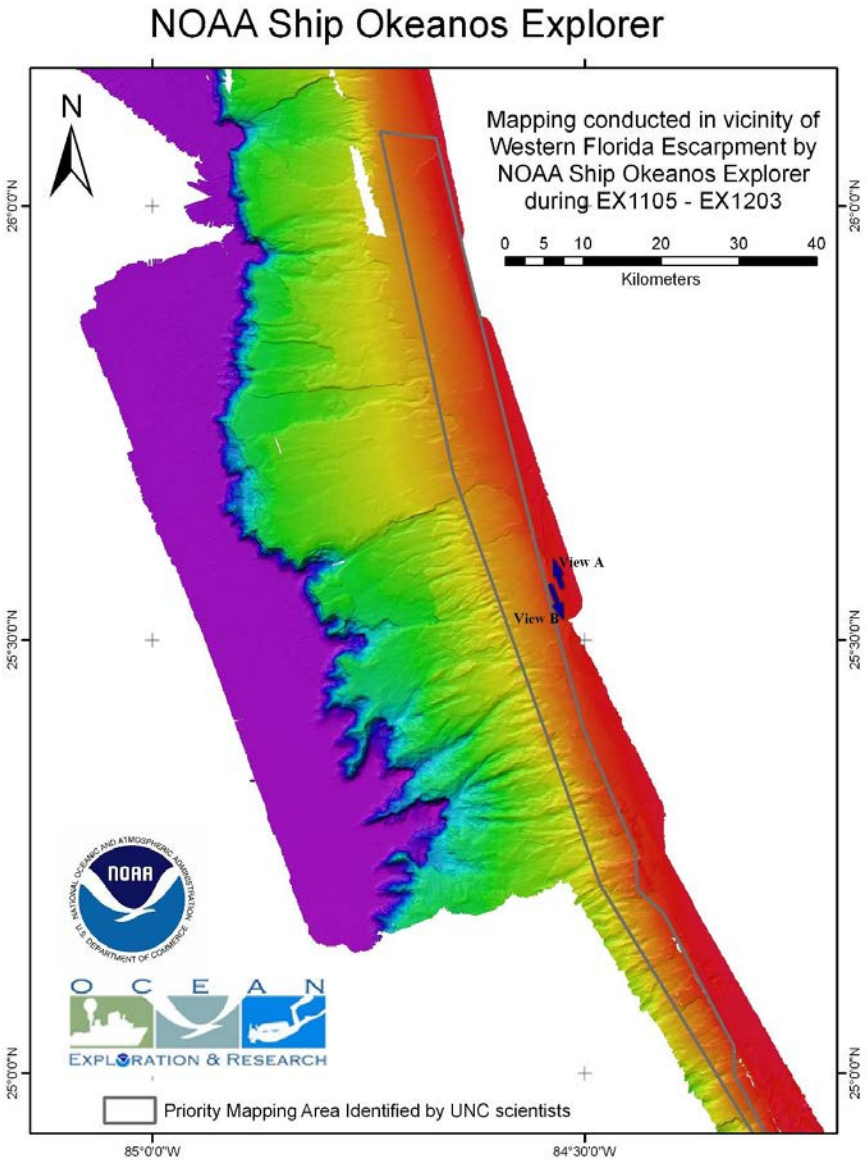

Figure 7: Western Florida Escarpment priority box. The bathymetric data shown is the compilation of all the bathymetric data that has been collected in this area during the ship's

expeditions in Gulf of Mexico since 2011. Zoomed in perspective views (A and B) are shown in Figure 8.

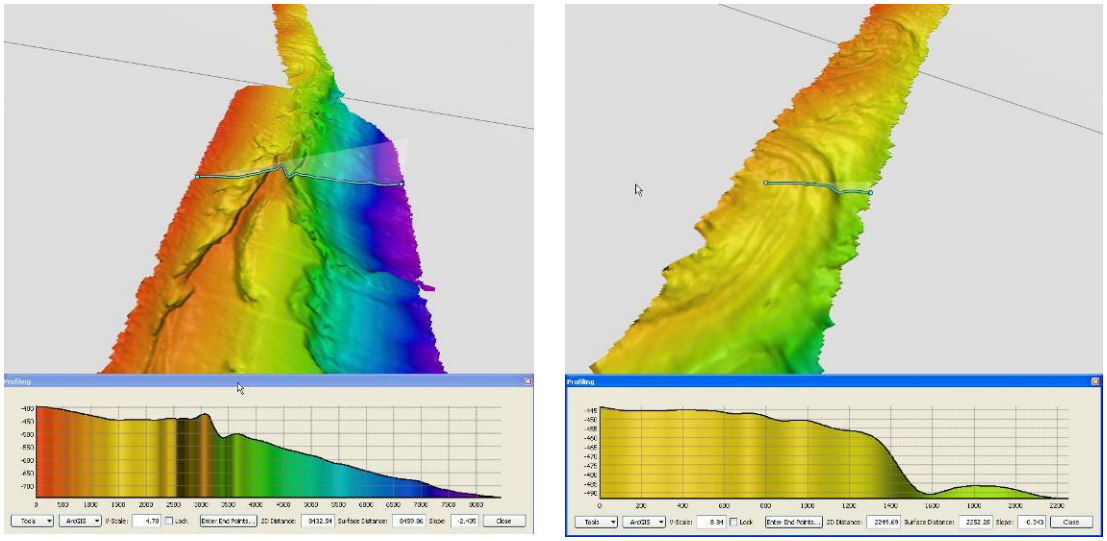

Figure 8: Left (A) and right (B) panels represent virtual-view direction using QPS/Fledermaus. View directions are shown in Figure 7.

d. South Atlantic Bight focused mapping areas

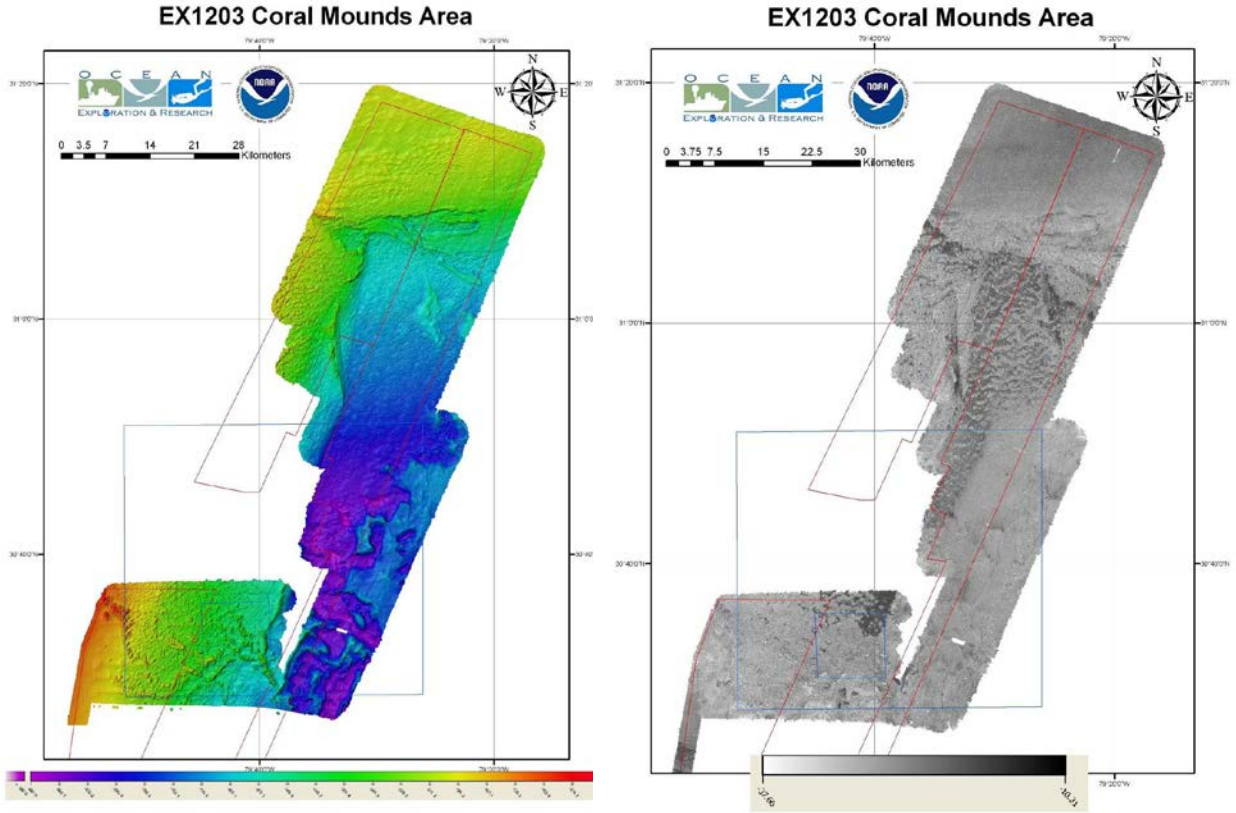

Figure 9: Left and right panel show the EM 302 seafloor bathymetry and backscatter respectively. Overlaid are the priority mapping boxes that were received from the scientists. Red boxes were received from Mike Rhode (UNC) and Blue boxes were received from Scott Harris (CoC)

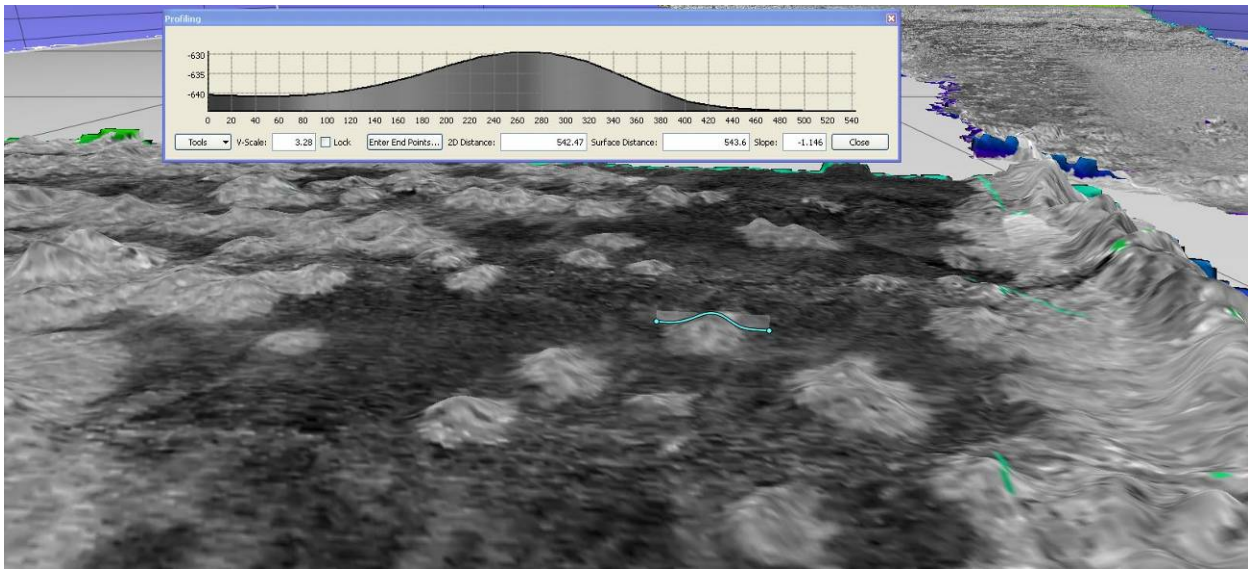

Figure 10: A zoomed in view of the seafloor backscatter data draped over the seafloor bathymetry. A profile is drawn across a topographic high presumed to be a coral mound. High backscatter shown in darker color.

These areas showed several topographic circular features which were ~ 200-500 m in diameter and varied in relief of ~ 10 – 20 m. A distinct anomalous character of these topographic high features was their low backscatter contrast from surrounding seafloor.

e. Blake Ridge Diapirs focused mapping areas

On 19 May the Tropical Storm Alberto intensified which forced the ship to take shelter in MayPort, FL. After leaving from MayPort, Fl on 21 May, the ship assessed the situation and a decision was made to not pursue the mapping of rest of Coral mounds and diapirs mapping areas. The image below summarizes the location of the storm with respect to the suggested mapping areas along with the ship's location as of 21 May 2012 PM.

During transit from MayPort, FL to Norfolk, VA on 22 May several flares were observed which were reported to USCG. Upon request from USCG a search pattern was conducted for any possible rescue operations. Later USCG notified that the flares were part of a military exercise.

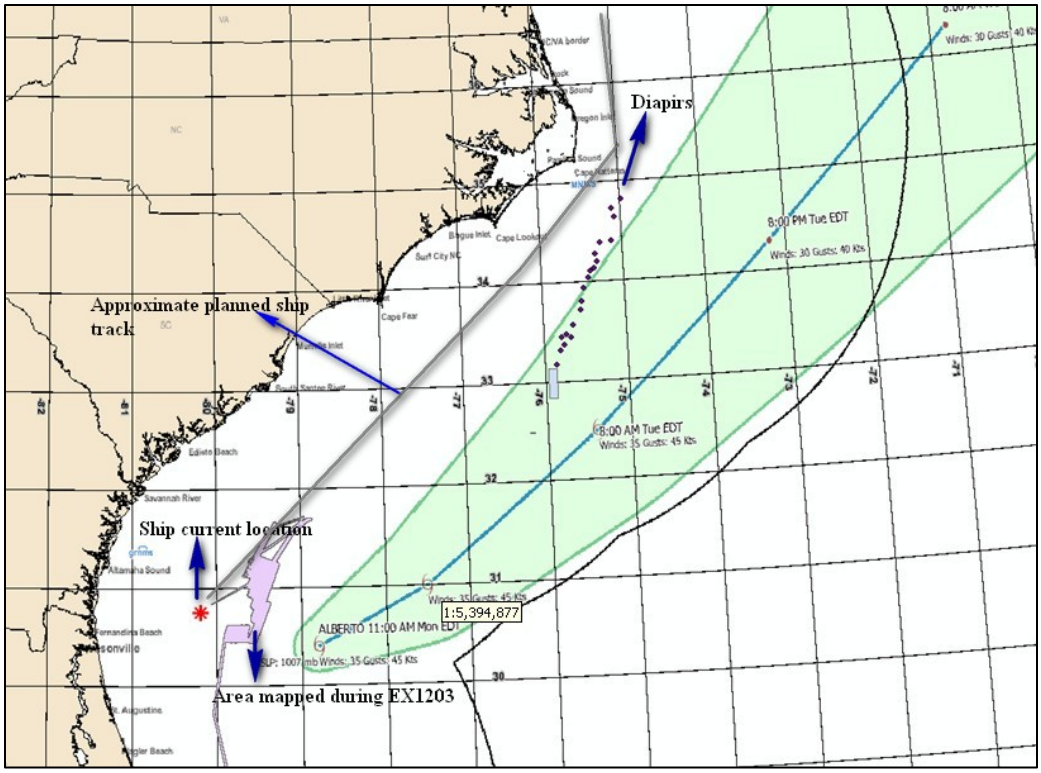

Figure 11: An image showing the projected track of Tropical Storm Alberto and the planned mapping areas (Diapirs). Tropical storm projected track from National Hurricane Center. Image created in ESRI ArcMap.

6. Mapping Statistics

Dates	05/05/12-05/23/12
Weather delays	1 day
Total non-mapping days	0 days
Total survey mapping days	9 days
Total transit mapping days	9 days
Line kilometers of survey	6761.8 km
Square kilometers mapped	17734.5 sq km
Number of bathymetric multibeam files	315
Data volume of raw multibeam data files	37.1 GB
Number of water column multibeam files	309
Data volume of water column multibeam files	75.3 GB
Number of XBT casts	83
Number of CTD casts	1
Beginning draft	14’6’’ (fwd) 14’8’’ (aft)
Ending draft	13’8’’ (fwd) 15’2’’
Average ship speed for survey	8.0 kts

7. Mapping Sonar Setup

The NOAA Ship *Okeanos Explorer* is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar. Appendix B contains a detailed description of sonar system functionality and technical specifications. For this cruise no changes were made to the standard setup of the mapping sonars onboard.

8. Data Acquisition and processing summary

Multibeam sonar (EM 302) data were acquired using Kongsberg Seafloor Information System (SIS ver. 3.6.4). SIS system accounts for all the static offsets and biases during real time acquisition. The motion data from the POS MV 320 (Ver. 4.0.2.0) was directly fed into SIS during data acquisition to account for ship motion (i.e. heave, roll, pitch). Yaw data was provided by the TSS gyro-compasses located on the bridge. Also the real time sound speed near the sonar head (dually measured by Reson Sound Speed sensor and a CTD sensor installed in proximity to the EM 302 receiver) was fed into SIS and the most updated acquired sound speed profile was used in real time to correct soundings for sound speed corrections during data acquisition. Unless there are problems observed in the data, there is no requirement to apply these corrections during post processing. The water column backscatter were collected all the time (except for few files listed in the multibeam data files list) which were recorded into separate to bottom bathymetry and backscatter data as *.wcd files.

CARIS HIPS/SIPS v. 6.3 was used to edit the bathymetric data from the EM 302 multibeam. Edited data was exported to ASCII text files and then imported to QPS Fledermaus Ver. 7.3.0c Build 968 for further processing, visualization, quality control, and product generation.

The QPS Fledermaus FMGT (Ver. 7.3.0c Build 968) software package was used for processing EM 302 bottom backscatter data. Processing watches were setup separately for water column backscatter processing. The observed location of seeps noted in the log book during data acquisition helped greatly in the process of detecting seeps during analysis of the water column backscatter in QPS. ‘Fan view’ and ‘Stacked view’ were used in the QPS water column tool to identify the possible seeps. The locations of the seeps detected in each line were then exported into a text file. Some of the characteristic examples of the seep shape and structure observed in the Green Canyon mapping area are provided below:

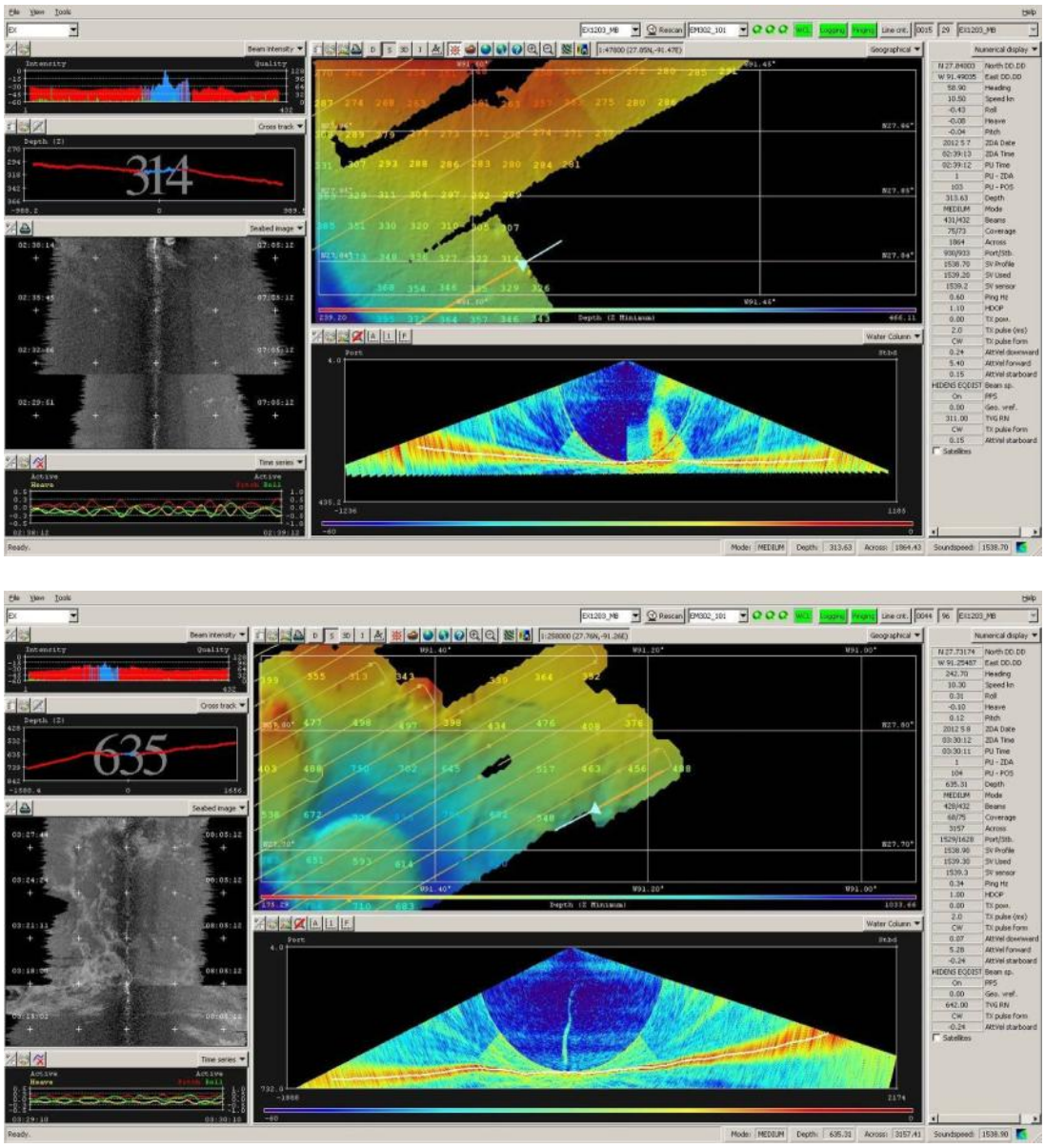

Figure 12: Screen grabs of SIS computer data acquisition showing two seeps observed in vicinity of Green Canyon.

EK 60 data were collected using Kongsberg GPT firm ware version 2.2.1 in the *.raw data file format.

The QPS Fledermaus MidWater software package (Ver. 7.3.0c Build 968) was used to process EM 302 water column backscatter and EK 60 data and view the resulting Fledermaus SD objects. The programs are the best method available to the mapping department for water column data processing.

The visualization of EK60 and EM302 data together showed a close agreement between all the seeps that were detected by EK60 were also picked up by EM 302. However, EM302 was able to

pick up also the seeps which were off nadir. An example of visualization of water column data showing the bathymetry, EK 60 single beam water column backscatter curtain and volume object of EM 302 is below:

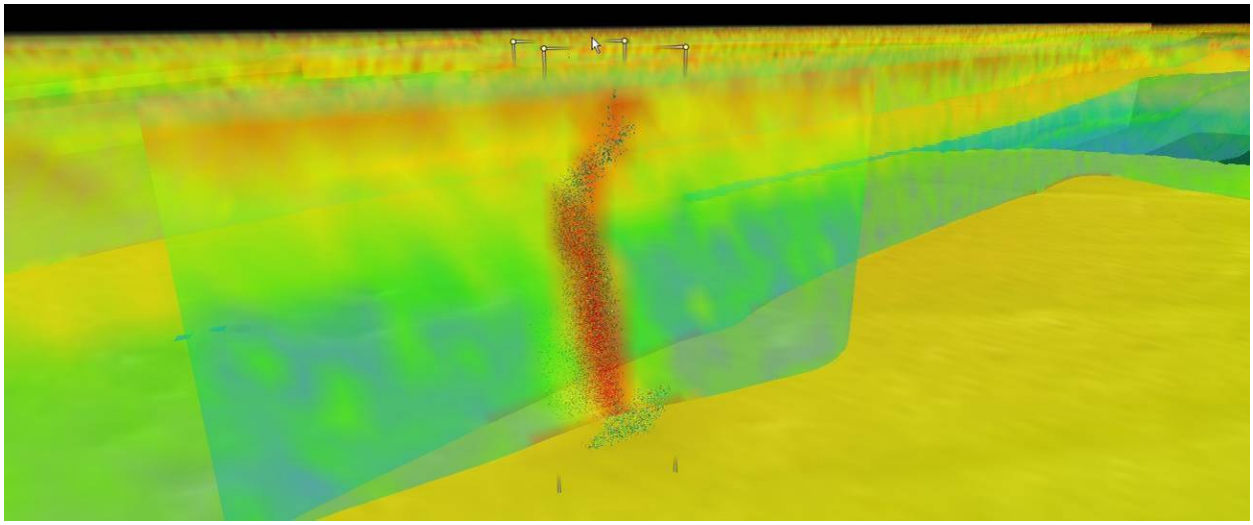

Figure 13: EK 60 water column curtain superimposed by the EM302 water column backscatter seep cloud (green points).

Sub-bottom profiler (SBP) data were collected using Knudsen Chirp 3260 v. 1.6.1. Data in SGY, and KEB file format were collected on most of the days between 0800-2000 local ship time using minimum power level to minimize SBP noise inside the ship's living quarters. Available post processing software onboard, Sonar Wiz v. 4004.0034 was found to only work with SGY file format but was found not to take into account the scale changes resulting in images which were not corrected for the scale changes appropriately.

EM 302 Trouble Shooting

During inport before the current cruise the EM302 data acquisition computer (SIS) windows were updated to the latest version. This resulted in issues related to virtual memory on the SIS computer that resulted in SIS crashing several times in beginning of the cruise. The windows system was then back tracked to an earlier version which seems to resolve the SIS issues.

9. Data Archival Procedures

All the data from the expedition has been submitted to NCDDC where the data are being prepared for onward submission to the archival centers. Following is the brief data pipeline excerpts from Data management plan, EX1203.

The multibeam survey data collected by bottom-looking and complementary sensors, data from the calibration instruments, and the products generated after the data are returned to and post-processed at shore will be archived at NGDC. These data will be accompanied with a collection level metadata record for NGDC as well as individual metadata records for each raw (level-0)

file, each edited (level-1) file and each data product (level-2) and report (level-3) generated as a result. In addition, the submission to NGDC will include the following:

- raw (level-0) mapping survey and water column data files,
- CTD and/or XBT profile data used for calibration in multibeam survey,
- post-processed, quality assured, and edited (level-1) data files,
- specific data products (level-2) including cumulative GeoTIF images, gridded bathymetric files, KML files, Fledermaus output files, and an ArcGrid format, and
- comprehensive mapping survey data summary (level-3) report.

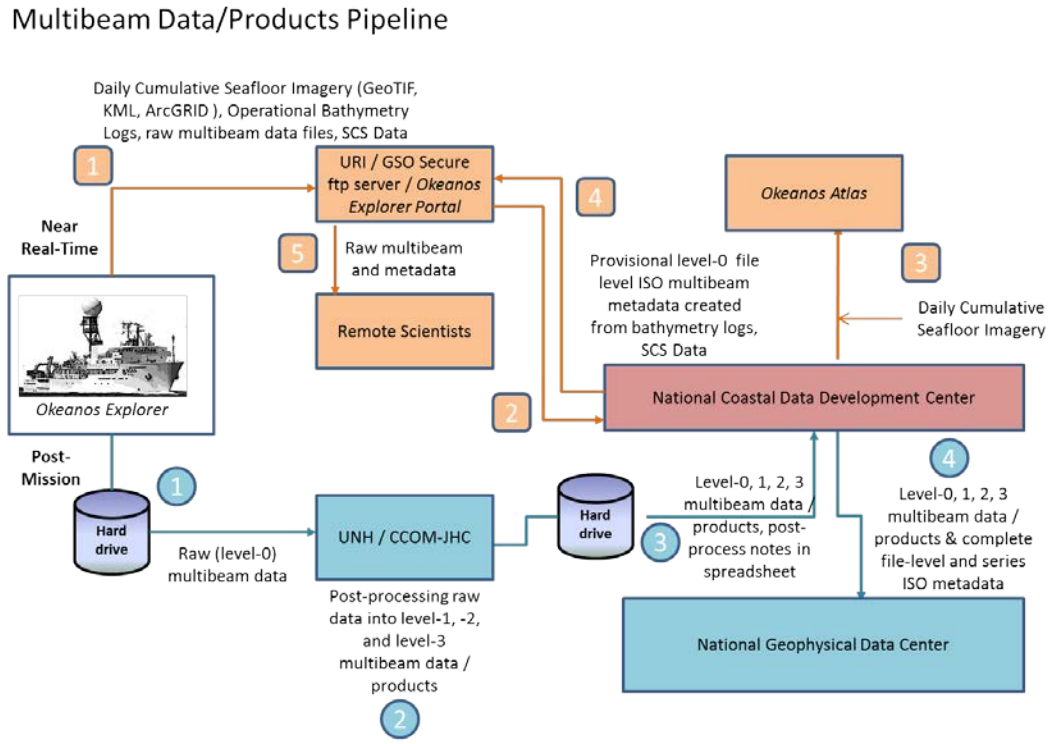

Figure 10: Multibeam Survey Data Archive Pipeline

Near Real-Time

1

The mapping survey team on the EX will include their operational processing spreadsheet in the folder that is targeted for synchronization to the SRS periodically throughout the day. As operational GeoTIFF images are created, these will also be saved to this folder.

2

The data management team at NCDDC pulls the GeoTIFF images, operational bathymetry processing spreadsheet and the SCS data streams for near real-time metadata generation and *Okeanos* Atlas update procedures.

3

Daily cumulative GeoTIFF images of the seafloor imagery are geo-located on the *Okeanos* Atlas by the GIS team at NCDDC.

4

Provisional metadata in an ISO format is generated for each raw (level-0) multibeam raw files using the SCS exported data, the operational processing spreadsheet and saved to the SRS.

5

Participating scientists wanting access to the raw multibeam in near real-time can pull the individual files with the metadata that provides operational and provisional processing steps and a disclaimer for non-QC status of the data.

Post-Mission

1 All bottom-looking sensor data and complementary data (water column and sound velocity) are saved to a hard-drive. This hard-drive will be either brought back or shipped to the University of New Hampshire Center for Coastal and Ocean Mapping (UNH CCOM) for post-processing.

2 A full complement of multibeam data from a 30-day EX cruise on which the Kongsberg EM302 multibeam system runs continuously will produce 200-300 Gigabytes of raw multibeam (37.5% of total volume) and water column data (62.5% of total volume). At UNH, the mapping team will post-process the multibeam data through the following steps:

- The raw (level-0) data will be saved to the IOCM/ CCOM file servers, where they will be quality checked and post-processed.
- The edited level-0 data is saved as level-1 data files in a non-proprietary format – ASCII xyz files (cleaned not gridded).
- The post-processing steps used to produce the level-1 data will be documented.
- Level-2 products will be generated from the level-1 data files.
- The post-processing steps used to produce the level-2 data products will be documented.
- The level-1 data, level-2 products, post-processing steps, and working data processing spreadsheets will be copied to the hard drive in a new folder. A processing spreadsheet for FY12 will contain the temporal and spatial limits of each file and any supplemental information documenting problems or issues that affected the quality of the data in that file.

3 The hard-drive will be shipped to the NCDDC within approximately 3 weeks from cruise end date.

4 At NCDDC, all multibeam related files will be post-processed through metadata generation procedures. Metadata will be generated for each individual survey track file (level-0 and -1), for accompanying CTD/XBT profile data sets, for composite xyz files, KMLs, GeoTIFs, png images, and Fledermaus output (level-2), and a set of data products and reports (level-3). The metadata will be added to the hard-drive and the hard-drive will be shipped to NGDC.

Following table provides details about multibeam survey metadata granularity and target archive dates:

Data Class	Instrument	Data Type	Format	Metadata Granularity	Archive Center
GEO	Kongsberg EM302 (30 kHz)	Multibeam Bathymetry, Bottom Backscatter, Water Column Backscatter (proprietary format read into MBSystem)	.all, .wcd (proprietary)	1 meta rec per .all file in Multibeam Data folder and subfolders	NGDC
GEO	Simrad EK60	Singlebeam (time,depth)	.txt, (ASCII), .raw (proprietary)	Included in the SCS feed	TBD
GEO	Knudsen CHIRP 3260 (3.5 kHz)	Sub-bottom profile	.sgy, .kea, .keb (proprietary)	1 meta rec = Subbottom Profile Data folder	NGDC
OCN	SeaBird SBE-911plus	CTD Cast	.hex, .con (Proprietary); .cnv, .hdr, .bl, .jpg (processed)	1 meta rec = CTD folder	NGDC
OCN	Sippican MK-21 eXpendable BathyThermograph (XBT)	XBT	.edf (ASCII), .rdf (proprietary)	1 meta rec = XBT folder	NGDC
OCN	RESON	Sound Velocity (m/s)	TBD	1 meta rec = RESON folder	NGDC
OCN	Calculated	Sound Velocity (m/s)	.asvp (ASCII)	1 meta rec = Profile_Data/SVP or Profile_Data/ASVP	NGDC

10. Cruise Calendar

Mon	Tue	Wed	Thu	Fri	Sat	Sun
					5 May Depart Galveston. Conducted Fire and Emergency Drill / Abandon Ship Drill	6 May Arrive in Green canyon mapping area
7 May Continue operations in Green canyon survey area. Oil Sheen observed - reported to NRC and USCG.	8 May Start transit towards Mississippi Canyon (MC) mapping area	9 May Continue mapping in MC mapping area. Small boat operations to train deck personnel on FRB Davits	10 May Continue mapping in MC mapping area	11 May Continue mapping in MC mapping area. Commence Transit to Western Florida Escarpment (WFE). Conducted Fire and Emergency Drill / Abandon Ship Drill	12 May Continue transit to WFE mapping area adjacent to existing bathymetry	13 May Commence WFE mapping. Commence. transit to Dry Tortugas diving site for ship's divers proficiency dive.
14 May Weather too rough for small boat / diving operations. Dive cancelled. Commenced transit through Florida Strait. Diving operations near Key Largo conducted	15 May Commence transit to Coral Mounds (CM) mapping area 1	16 May Commenced mapping in CM mapping area # 1	17 May Continued mapping in CM mapping area #1. Test CTD Cast.	18 May Commenced transit to CM mapping area # 2. Abandon Ship Drill, Fire & Emergency Drill and MOB Drill	19 May Tropical Storm 'Alberto' formed offshore Carolinas. Due to rough weather returned to CM mapping area # 1	20 May 'Alberto' predicted to intensify – Pulled into MayPort, FL till 'Alberto' clears the area
21 May 1000 Departed Mayport Naval Station, Mayport, FL	22 May Search pattern conducted at request of USCG after observing a flare later determined to	23 May Arrived Norfolk 1800				

	be related to military exercises in the area. Continue transit towards Norfolk, VA.					

11. References

Office of Ocean Exploration Draft Workshop Summary, NOAA Workshop on Systematic Telepresence-Enabled Exploration in the Atlantic Basin, May 10-11, 2011, Coastal Institute Building, University of Rhode Island, Narragansett, Rhode Island, , September 19, 201. Available online at: ftp://dossier.ogp.noaa.gov/OER/Atlantic_Workshop_2011/Individual_Draft_Summary_Files/Atl_Basin_Workshop_2011_Summary_Draft%2020110919.docx

Lobecker, E., Malik, M., Nadeau, M. and Skarke, A., Mapping Systems Readiness Report 2012, NOAA Ship *Okeanos Explorer*, March 2012.

Office of Ocean Exploration and Research, EX1203, Gulf of Mexico Exploration, Data Management Plan, April 2012.

Office of Ocean Exploration and Research, EX1203, Gulf of Mexico Exploration, Project instructions, April 2012.

12. Appendices

Appendix A: Tables of data files collected

Table of Multibeam EM 302 files collected. File Name format:
Line Number _ Date_Time_CruiseID_MB.all
Note: Issues with Java and repeated crashes of SIS caused issues with filenames and loss of water column data files.

Multibeam File	Water Column file	Comments
0000_20120506_031921_EX.all	0000_20120506_031921_EX.wcd	Galveston, TX to Green Canyon Mapping Grounds
0001_20120506_051921_EX.all	0001_20120506_051921_EX.wcd	Galveston, TX to Green Canyon Mapping Grounds
0002_20120506_071921_EX.all	0002_20120506_071921_EX.wcd	Galveston, TX to Green Canyon Mapping Grounds
0003_20120506_073501_EX.all	0003_20120506_073501_EX.wcd	Galveston, TX to Green Canyon Mapping Grounds
0004_20120506_074034_EX.all	0004_20120506_074034_EX.wcd	Galveston, TX to Green Canyon Mapping Grounds
0005_20120506_074411_EX.all	0005_20120506_074411_EX.wcd	Galveston, TX to Green Canyon Mapping Grounds
0000_20120506_081712_EX1203_MB.all	0000_20120506_081712_EX1203_MB.wcd	Galveston, TX to Green Canyon Mapping Grounds
0001_20120506_085425_EX1203_MB.all	0001_20120506_085425_EX1203_MB.wcd	Galveston, TX to Green Canyon Mapping Grounds
0002_20120506_105426_EX1203_MB.all	0002_20120506_105426_EX1203_MB.wcd	Green Canyon Mapping Grounds
0003_20120506_125424_EX1203_MB.all	0003_20120506_125424_EX1203_MB.wcd	Green Canyon Mapping Grounds
0004_20120506_135322_EX1203_MB.all	0004_20120506_135322_EX1203_MB.wcd	Green Canyon Mapping Grounds
0005_20120506_140200_EX1203_MB.all	0005_20120506_140200_EX1203_MB.wcd	Green Canyon Mapping Grounds
0006_20120506_160201_EX1203_MB.all	N/A	Green Canyon Mapping Grounds
0007_20120506_181405_EX1203_MB.all	N/A	Green Canyon Mapping Grounds
0008_20120506_183039_EX1203_MB.all	0008_20120506_183039_EX1203_MB.wcd	Green Canyon Mapping Grounds
0009_20120506_203036_EX1203_MB.all	0009_20120506_203036_EX1203_MB.wcd	Green Canyon Mapping Grounds
0010_20120506_213733_EX1203_MB.all	0010_20120506_213733_EX1203_MB.wcd	Green Canyon Mapping Grounds
0011_20120506_214514_EX1203_MB.all	0011_20120506_214514_EX1203_MB.wcd	Green Canyon Mapping Grounds
0012_20120506_234514_EX1203_MB.all	0012_20120506_234514_EX1203_MB.wcd	Green Canyon Mapping Grounds
0013_20120507_000004_EX1203_MB.all	0013_20120507_000004_EX1203_MB.wcd	Green Canyon Mapping Grounds
0014_20120507_005913_EX1203_MB.all	0014_20120507_005913_EX1203_MB.wcd	Green Canyon Mapping Grounds
0015_20120507_010740_EX1203_MB.all	0015_20120507_010740_EX1203_MB.wcd	Green Canyon Mapping Grounds
0016_20120507_024945_EX1203_MB.all	0016_20120507_024945_EX1203_MB.wcd	Green Canyon Mapping Grounds
0017_20120507_025919_EX1203_MB.all	0017_20120507_025919_EX1203_MB.wcd	Green Canyon Mapping Grounds
0018_20120507_044748_EX1203_MB.all	0018_20120507_044748_EX1203_MB.wcd	Green Canyon Mapping Grounds
0019_20120507_045633_EX1203_MB.all	0019_20120507_045633_EX1203_MB.wcd	Green Canyon Mapping Grounds
0020_20120507_064955_EX1203_MB.all	0020_20120507_064955_EX1203_MB.wcd	Green Canyon Mapping Grounds
0021_20120507_070005_EX1203_MB.all	0021_20120507_070005_EX1203_MB.wcd	Green Canyon Mapping Grounds
0022_20120507_090005_EX1203_MB.all	0022_20120507_090005_EX1203_MB.wcd	Green Canyon Mapping Grounds
0023_20120507_090013_EX1203_MB.all	0023_20120507_090013_EX1203_MB.wcd	Green Canyon Mapping Grounds

0024_20120507_090934_EX1203_MB.all	0024_20120507_090934_EX1203_MB.wcd	Green Canyon Mapping Grounds
0025_20120507_110934_EX1203_MB.all	0025_20120507_110934_EX1203_MB.wcd	Green Canyon Mapping Grounds
0026_20120507_114855_EX1203_MB.all	0026_20120507_114855_EX1203_MB.wcd	Green Canyon Mapping Grounds
0027_20120507_115737_EX1203_MB.all	0027_20120507_115737_EX1203_MB.wcd	Green Canyon Mapping Grounds
0028_20120507_135737_EX1203_MB.all	0028_20120507_135737_EX1203_MB.wcd	Green Canyon Mapping Grounds
0029_20120507_144327_EX1203_MB.all	0029_20120507_144327_EX1203_MB.wcd	Green Canyon Mapping Grounds
0030_20120507_145404_EX1203_MB.all	0030_20120507_145404_EX1203_MB.wcd	Green Canyon Mapping Grounds
0031_20120507_165403_EX1203_MB.all	0031_20120507_165403_EX1203_MB.wcd	Green Canyon Mapping Grounds
0032_20120507_173942_EX1203_MB.all	0032_20120507_173942_EX1203_MB.wcd	Green Canyon Mapping Grounds
0033_20120507_183154_EX1203_MB.all	0033_20120507_183154_EX1203_MB.wcd	Green Canyon Mapping Grounds
0034_20120507_195645_EX1203_MB.all	0034_20120507_195645_EX1203_MB.wcd	Green Canyon Mapping Grounds
0035_20120507_200456_EX1203_MB.all	0035_20120507_200456_EX1203_MB.wcd	Green Canyon Mapping Grounds
0036_20120507_220455_EX1203_MB.all	0036_20120507_220455_EX1203_MB.wcd	Green Canyon Mapping Grounds
0037_20120507_221526_EX1203_MB.all	0037_20120507_221526_EX1203_MB.wcd	Green Canyon Mapping Grounds
0038_20120507_222350_EX1203_MB.all	0038_20120507_222350_EX1203_MB.wcd	Green Canyon Mapping Grounds
0039_20120508_000228_EX1203_MB.all	0039_20120508_000228_EX1203_MB.wcd	Green Canyon Mapping Grounds
0040_20120508_003423_EX1203_MB.all	0040_20120508_003423_EX1203_MB.wcd	Green Canyon Mapping Grounds
0041_20120508_004233_EX1203_MB.all	0041_20120508_004233_EX1203_MB.wcd	Green Canyon Mapping Grounds
0042_20120508_024230_EX1203_MB.all	0042_20120508_024230_EX1203_MB.wcd	Green Canyon Mapping Grounds
0043_20120508_025458_EX1203_MB.all	0043_20120508_025458_EX1203_MB.wcd	Green Canyon Mapping Grounds
0044_20120508_030513_EX1203_MB.all	0044_20120508_030513_EX1203_MB.wcd	Green Canyon Mapping Grounds
0045_20120508_050426_EX1203_MB.all	0045_20120508_050426_EX1203_MB.wcd	Green Canyon Mapping Grounds
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0047_20120508_070941_EX1203_MB.all	0047_20120508_070941_EX1203_MB.wcd	Green Canyon Mapping Grounds
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0049_20120508_085149_EX1203_MB.all	0049_20120508_085149_EX1203_MB.wcd	Green Canyon Mapping Grounds
0050_20120508_090059_EX1203_MB.all	0050_20120508_090059_EX1203_MB.wcd	Green Canyon Mapping Grounds
0051_20120508_090115_EX1203_MB.all	0051_20120508_090115_EX1203_MB.wcd	Green Canyon Mapping Grounds
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0069_20120508_232026_EX1203_MB.all	0069_20120508_232026_EX1203_MB.wcd	Green Canyon Mapping Grounds to Mississippi Canyon Mapping Grounds
0070_20120509_000001_EX1203_MB.all	0070_20120509_000001_EX1203_MB.wcd	Green Canyon Mapping Grounds to Mississippi Canyon Mapping Grounds
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0090_20120510_023359_EX1203_MB.all	0090_20120510_023359_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0091_20120510_041119_EX1203_MB.all	0091_20120510_041119_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0092_20120510_042803_EX1203_MB.all	0092_20120510_042803_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
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0096_20120510_102153_EX1203_MB.all	N/A	Mississippi Canyon Mapping Grounds
0097_20120510_115520_EX1203_MB.all	N/A	Mississippi Canyon Mapping Grounds
0098_20120510_120905_EX1203_MB.all	0098_20120510_120905_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0099_20120510_140903_EX1203_MB.all	0099_20120510_140903_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0100_20120510_155730_EX1203_MB.all	0100_20120510_155730_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0101_20120510_161055_EX1203_MB.all	0101_20120510_161055_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0102_20120510_181056_EX1203_MB.all	0102_20120510_181056_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0103_20120510_200917_EX1203_MB.all	0103_20120510_200917_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds

0104_20120510_202234_EX1203_MB.all	0104_20120510_202234_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0105_20120510_222234_EX1203_MB.all	0105_20120510_222234_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0106_20120510_234813_EX1203_MB.all	0106_20120510_234813_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0107_20120511_000004_EX1203_MB.all	0107_20120511_000004_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0108_20120511_020004_EX1203_MB.all	0108_20120511_020004_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0109_20120511_022253_EX1203_MB.all	0109_20120511_022253_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0110_20120511_024641_EX1203_MB.all	0110_20120511_024641_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0111_20120511_041055_EX1203_MB.all	0111_20120511_041055_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0112_20120511_042330_EX1203_MB.all	0112_20120511_042330_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0113_20120511_052938_EX1203_MB.all	0113_20120511_052938_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0114_20120511_054209_EX1203_MB.all	0114_20120511_054209_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0115_20120511_065123_EX1203_MB.all	0115_20120511_065123_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0116_20120511_072544_EX1203_MB.all	0116_20120511_072544_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0117_20120511_092211_EX1203_MB.all	0117_20120511_092211_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0118_20120511_095017_EX1203_MB.all	0118_20120511_095017_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0119_20120511_113116_EX1203_MB.all	0119_20120511_113116_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds
0120_20120511_130450_EX1203_MB.all	0120_20120511_130450_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0121_20120511_150456_EX1203_MB.all	0121_20120511_150456_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0122_20120511_170450_EX1203_MB.all	0122_20120511_170450_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0123_20120511_190451_EX1203_MB.all	0123_20120511_190451_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0124_20120511_210449_EX1203_MB.all	0124_20120511_210449_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0125_20120511_230458_EX1203_MB.all	0125_20120511_230458_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0126_20120511_233107_EX1203_MB.all	0126_20120511_233107_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0127_20120511_233548_EX1203_MB.all	0127_20120511_233548_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0128_20120512_000005_EX1203_MB.all	0128_20120512_000005_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0129_20120512_020005_EX1203_MB.all	0129_20120512_020005_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0130_20120512_033526_EX1203_MB.all	0130_20120512_033526_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0131_20120512_033838_EX1203_MB.all	0131_20120512_033838_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0132_20120512_043032_EX1203_MB.all	0132_20120512_043032_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0133_20120512_043508_EX1203_MB.all	0133_20120512_043508_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0134_20120512_063500_EX1203_MB.all	0134_20120512_063500_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0135_20120512_071053_EX1203_MB.all	0135_20120512_071053_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0136_20120512_081434_EX1203_MB.all	0136_20120512_081434_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0137_20120512_081828_EX1203_MB.all	0137_20120512_081828_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0138_20120512_101829_EX1203_MB.all	0138_20120512_101829_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0139_20120512_121830_EX1203_MB.all	0139_20120512_121830_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0142_20120512_135923_EX1203_MB.all	0142_20120512_135923_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)

0143_20120512_155919_EX1203_MB.all	0143_20120512_155919_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0144_20120512_175918_EX1203_MB.all	0144_20120512_175918_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0145_20120512_195917_EX1203_MB.all	0145_20120512_195917_EX1203_MB.wcd	Mississippi Canyon Mapping Grounds to Florida Escarpment (Area B)
0146_20120512_215918_EX1203_MB.all	0146_20120512_215918_EX1203_MB.wcd	Florida Escarpment (Area B)
0147_20120512_235501_EX1203_MB.all	0147_20120512_235501_EX1203_MB.wcd	Florida Escarpment (Area B)
0148_20120513_000001_EX1203_MB.all	0148_20120513_000001_EX1203_MB.wcd	Florida Escarpment (Area B)
0149_20120513_003807_EX1203_MB.all	0149_20120513_003807_EX1203_MB.wcd	Florida Escarpment (Area B)
0150_20120513_005027_EX1203_MB.all	0150_20120513_005027_EX1203_MB.wcd	Florida Escarpment (Area B)
0151_20120513_015621_EX1203_MB.all	0151_20120513_015621_EX1203_MB.wcd	Florida Escarpment (Area B)
0152_20120513_015930_EX1203_MB.all	0152_20120513_015930_EX1203_MB.wcd	Florida Escarpment (Area B)
0153_20120513_035932_EX1203_MB.all	0153_20120513_035932_EX1203_MB.wcd	Florida Escarpment (Area B)
0154_20120513_040124_EX1203_MB.all	0154_20120513_040124_EX1203_MB.wcd	Florida Escarpment (Area B)
0155_20120513_041057_EX1203_MB.all	0155_20120513_041057_EX1203_MB.wcd	Florida Escarpment (Area B)
0156_20120513_060812_EX1203_MB.all	0156_20120513_060812_EX1203_MB.wcd	Florida Escarpment (Area B)
0157_20120513_061923_EX1203_MB.all	0157_20120513_061923_EX1203_MB.wcd	Florida Escarpment (Area B)
0158_20120513_081924_EX1203_MB.all	0158_20120513_081924_EX1203_MB.wcd	Florida Escarpment (Area B)
0159_20120513_083302_EX1203_MB.all	0159_20120513_083302_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0160_20120513_095535_EX1203_MB.all	0160_20120513_095535_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0161_20120513_115534_EX1203_MB.all	0161_20120513_115534_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0162_20120513_135534_EX1203_MB.all	0162_20120513_135534_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0163_20120513_155533_EX1203_MB.all	0163_20120513_155533_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0164_20120513_175400_EX1203_MB.all	0164_20120513_175400_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0165_20120513_195402_EX1203_MB.all	0165_20120513_195402_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0166_20120513_204654_EX1203_MB.all	0166_20120513_204654_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0167_20120513_224653_EX1203_MB.all	0167_20120513_224653_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0168_20120513_232415_EX1203_MB.all	0168_20120513_232415_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0169_20120514_000003_EX1203_MB.all	0169_20120514_000003_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0170_20120514_020002_EX1203_MB.all	0170_20120514_020002_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0171_20120514_040002_EX1203_MB.all	0171_20120514_040002_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0172_20120514_045819_EX1203_MB.all	0172_20120514_045819_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0173_20120514_065817_EX1203_MB.all	0173_20120514_065817_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0174_20120514_085818_EX1203_MB.all	0174_20120514_085818_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0175_20120514_105818_EX1203_MB.all	0175_20120514_105818_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0176_20120514_125818_EX1203_MB.all	0176_20120514_125818_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0177_20120514_145819_EX1203_MB.all	0177_20120514_145819_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0178_20120514_151749_EX1203_MB.all	0178_20120514_151749_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds

0179_20120514_224136_EX1203_MB.all	0179_20120514_224136_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0180_20120515_000001_EX1203_MB.all	0180_20120515_000001_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0181_20120515_020002_EX1203_MB.all	0181_20120515_020002_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0182_20120515_040001_EX1203_MB.all	0182_20120515_040001_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0183_20120515_060002_EX1203_MB.all	0183_20120515_060002_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0184_20120515_080000_EX1203_MB.all	0184_20120515_080000_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0185_20120515_100000_EX1203_MB.all	0185_20120515_100000_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0186_20120515_105430_EX1203_MB.all	0186_20120515_105430_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0187_20120515_125429_EX1203_MB.all	0187_20120515_125429_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0188_20120515_145430_EX1203_MB.all	0188_20120515_145430_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0189_20120515_165429_EX1203_MB.all	0189_20120515_165429_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0191_20120515_192450_EX1203_MB.all	0191_20120515_192450_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0192_20120515_204342_EX1203_MB.all	0192_20120515_204342_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0193_20120515_224344_EX1203_MB.all	0193_20120515_224344_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0194_20120516_000045_EX1203_MB.all	0194_20120516_000045_EX1203_MB.wcd	Florida Escarpment (Area B) to Coral Mounds Mapping Grounds
0195_20120516_020044_EX1203_MB.all	0195_20120516_020044_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0196_20120516_040045_EX1203_MB.all	0196_20120516_040045_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0197_20120516_042756_EX1203_MB.all	0197_20120516_042756_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0198_20120516_043326_EX1203_MB.all	0198_20120516_043326_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0199_20120516_054535_EX1203_MB.all	0199_20120516_054535_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0200_20120516_055935_EX1203_MB.all	0200_20120516_055935_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0201_20120516_072144_EX1203_MB.all	0201_20120516_072144_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0202_20120516_073524_EX1203_MB.all	0202_20120516_073524_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0203_20120516_084411_EX1203_MB.all	0203_20120516_084411_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0204_20120516_085835_EX1203_MB.all	0204_20120516_085835_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0205_20120516_102210_EX1203_MB.all	0205_20120516_102210_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0206_20120516_103601_EX1203_MB.all	0206_20120516_103601_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0207_20120516_114320_EX1203_MB.all	0207_20120516_114320_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0208_20120516_115334_EX1203_MB.all	0208_20120516_115334_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0209_20120516_131312_EX1203_MB.all	0209_20120516_131312_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0210_20120516_133000_EX1203_MB.all	0210_20120516_133000_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0211_20120516_143942_EX1203_MB.all	0211_20120516_143942_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0212_20120516_145058_EX1203_MB.all	0212_20120516_145058_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0213_20120516_160816_EX1203_MB.all	0213_20120516_160816_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0214_20120516_162143_EX1203_MB.all	0214_20120516_162143_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0215_20120516_180557_EX1203_MB.all	0215_20120516_180557_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0216_20120516_200558_EX1203_MB.all	0216_20120516_200558_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0217_20120516_203555_EX1203_MB.all	0217_20120516_203555_EX1203_MB.wcd	Coral Mounds Mapping Grounds

0218_20120516_205019_EX1203_MB.all	0218_20120516_205019_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0219_20120516_225020_EX1203_MB.all	0219_20120516_225020_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0000_20120516_225320_EX1203_MB.all	0000_20120516_225320_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0219_20120516_230323_EX1203_MB.all	0219_20120516_230323_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0220_20120516_234530_EX1203_MB.all	0220_20120516_234530_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0221_20120517_000003_EX1203_MB.all	0221_20120517_000003_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0222_20120517_020003_EX1203_MB.all	0222_20120517_020003_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0223_20120517_040001_EX1203_MB.all	0223_20120517_040001_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0224_20120517_042716_EX1203_MB.all	0224_20120517_042716_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0225_20120517_044630_EX1203_MB.all	0225_20120517_044630_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0226_20120517_064632_EX1203_MB.all	0226_20120517_064632_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0227_20120517_084632_EX1203_MB.all	0227_20120517_084632_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0228_20120517_090334_EX1203_MB.all	0228_20120517_090334_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0229_20120517_091233_EX1203_MB.all	0229_20120517_091233_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0230_20120517_111234_EX1203_MB.all	0230_20120517_111234_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0231_20120517_124823_EX1203_MB.all	0231_20120517_124823_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0232_20120517_130352_EX1203_MB.all	0232_20120517_130352_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0233_20120517_150353_EX1203_MB.all	0233_20120517_150353_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0234_20120517_162748_EX1203_MB.all	0234_20120517_162748_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0235_20120517_163655_EX1203_MB.all	0235_20120517_163655_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0236_20120517_192555_EX1203_MB.all	0236_20120517_192555_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0237_20120517_200945_EX1203_MB.all	0237_20120517_200945_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0238_20120517_211927_EX1203_MB.all	0238_20120517_211927_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0239_20120517_213100_EX1203_MB.all	0239_20120517_213100_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0240_20120517_233059_EX1203_MB.all	0240_20120517_233059_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0241_20120518_000003_EX1203_MB.all	0241_20120518_000003_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0242_20120518_002142_EX1203_MB.all	0242_20120518_002142_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0243_20120518_003331_EX1203_MB.all	0243_20120518_003331_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0244_20120518_023332_EX1203_MB.all	0244_20120518_023332_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0245_20120518_023423_EX1203_MB.all	0245_20120518_023423_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0246_20120518_024200_EX1203_MB.all	0246_20120518_024200_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0247_20120518_044202_EX1203_MB.all	0247_20120518_044202_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0248_20120518_053942_EX1203_MB.all	0248_20120518_053942_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0249_20120518_055128_EX1203_MB.all	0249_20120518_055128_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0250_20120518_075128_EX1203_MB.all	0250_20120518_075128_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0251_20120518_075928_EX1203_MB.all	0251_20120518_075928_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0252_20120518_081111_EX1203_MB.all	0252_20120518_081111_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0253_20120518_101110_EX1203_MB.all	0253_20120518_101110_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0254_20120518_103953_EX1203_MB.all	0254_20120518_103953_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0255_20120518_105101_EX1203_MB.all	0255_20120518_105101_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0256_20120518_123941_EX1203_MB.all	0256_20120518_123941_EX1203_MB.wcd	Coral Mounds Mapping Grounds

0257_20120518_134113_EX1203_MB.all	0257_20120518_134113_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0258_20120518_142808_EX1203_MB.all	0258_20120518_142808_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0259_20120518_144916_EX1203_MB.all	0259_20120518_144916_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0260_20120518_151833_EX1203_MB.all	0260_20120518_151833_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0261_20120518_171832_EX1203_MB.all	0261_20120518_171832_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0262_20120518_175646_EX1203_MB.all	0262_20120518_175646_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0263_20120518_195647_EX1203_MB.all	0263_20120518_195647_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0264_20120518_215645_EX1203_MB.all	0264_20120518_215645_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0265_20120518_230014_EX1203_MB.all	0265_20120518_230014_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0266_20120519_000010_EX1203_MB.all	0266_20120519_000010_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0267_20120519_020009_EX1203_MB.all	0267_20120519_020009_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0268_20120519_022737_EX1203_MB.all	0268_20120519_022737_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0269_20120519_024116_EX1203_MB.all	0269_20120519_024116_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0270_20120519_044116_EX1203_MB.all	0270_20120519_044116_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0271_20120519_064115_EX1203_MB.all	0271_20120519_064115_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0272_20120519_071919_EX1203_MB.all	0272_20120519_071919_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0273_20120519_073530_EX1203_MB.all	0273_20120519_073530_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0274_20120519_093532_EX1203_MB.all	0274_20120519_093532_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0275_20120519_113530_EX1203_MB.all	0275_20120519_113530_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0276_20120519_124419_EX1203_MB.all	0276_20120519_124419_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0277_20120519_125629_EX1203_MB.all	0277_20120519_125629_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0278_20120519_132143_EX1203_MB.all	0278_20120519_132143_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0279_20120519_152143_EX1203_MB.all	0279_20120519_152143_EX1203_MB.wcd	Coral Mounds Mapping Grounds
0280_20120519_170642_EX1203_MB.all	0280_20120519_170642_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0281_20120519_172619_EX1203_MB.all	0281_20120519_172619_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0282_20120519_192557_EX1203_MB.all	0282_20120519_192557_EX1203_MB.wcd	Coral Mounds Mapping Grounds to Blake Plateau (Aborted)
0283_20120519_212557_EX1203_MB.all	0283_20120519_212557_EX1203_MB.wcd	Tropical Storm Alberto: Transit to Naval Station Mayport, Jacksonville, FL
0284_20120519_232557_EX1203_MB.all	0284_20120519_232557_EX1203_MB.wcd	Tropical Storm Alberto: Transit to Naval Station Mayport, Jacksonville, FL
0285_20120520_000004_EX1203_MB.all	0285_20120520_000004_EX1203_MB.wcd	Tropical Storm Alberto: Transit to Naval Station Mayport, Jacsonville, FL
0286_20120520_020004_EX1203_MB.all	0286_20120520_020004_EX1203_MB.wcd	Tropical Storm Alberto: Transit to Naval Station Mayport, Jacksonville, FL
0287_20120520_040003_EX1203_MB.all	0287_20120520_040003_EX1203_MB.wcd	Tropical Storm Alberto: Transit to Naval Station Mayport, Jacksonville, FL
0288_20120521_210313_EX1203_MB.all	0288_20120521_210313_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0289_20120521_222816_EX1203_MB.all	0289_20120521_222816_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0290_20120522_000032_EX1203_MB.all	0290_20120522_000032_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0291_20120522_020030_EX1203_MB.all	0291_20120522_020030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0292_20120522_040030_EX1203_MB.all	0292_20120522_040030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0293_20120522_060030_EX1203_MB.all	0293_20120522_060030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA

0294_20120522_080031_EX1203_MB.all	0294_20120522_080031_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0295_20120522_100030_EX1203_MB.all	0295_20120522_100030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0296_20120522_120030_EX1203_MB.all	0296_20120522_120030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0297_20120522_140030_EX1203_MB.all	0297_20120522_140030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0298_20120522_160030_EX1203_MB.all	0298_20120522_160030_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0299_20120522_180029_EX1203_MB.all	0299_20120522_180029_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0300_20120522_193442_EX1203_MB.all	0300_20120522_193442_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0301_20120522_213441_EX1203_MB.all	0301_20120522_213441_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0302_20120522_233441_EX1203_MB.all	0302_20120522_233441_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0303_20120523_000008_EX1203_MB.all	0303_20120523_000008_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0304_20120523_020011_EX1203_MB.all	0304_20120523_020011_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0305_20120523_032606_EX1203_MB.all	0305_20120523_032606_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA
0306_20120523_052601_EX1203_MB.all	0306_20120523_052601_EX1203_MB.wcd	Naval Station Mayport, Jacksonville, FL to Norfolk, VA

EK 60 files Name format Cruise ID_EK60_Date_Time.raw

EX1203-D20120506-T001331.raw	EX1203-D20120508-T222335.raw	EX1203-D20120508-T223321.raw
EX1203-D20120508-T224235.raw	EX1203-D20120508-T225126.raw	EX1203-D20120508-T172709.raw
EX1203-D20120508-T173601.raw	EX1203-D20120508-T174454.raw	EX1203-D20120508-T175358.raw
EX1203-D20120508-T180452.raw	EX1203-D20120508-T181425.raw	EX1203-D20120508-T182400.raw
EX1203-D20120508-T183317.raw	EX1203-D20120508-T184227.raw	EX1203-D20120508-T185154.raw
EX1203-D20120508-T190128.raw	EX1203-D20120508-T191035.raw	EX1203-D20120508-T191926.raw
EX1203-D20120508-T192831.raw	EX1203-D20120508-T193812.raw	EX1203-D20120508-T194816.raw
EX1203-D20120508-T195810.raw	EX1203-D20120508-T200840.raw	EX1203-D20120508-T201853.raw
EX1203-D20120508-T202923.raw	EX1203-D20120508-T203905.raw	EX1203-D20120508-T204917.raw
EX1203-D20120508-T212046.raw	EX1203-D20120508-T213004.raw	EX1203-D20120508-T213857.raw
EX1203-D20120508-T214752.raw	EX1203-D20120508-T215641.raw	EX1203-D20120508-T220527.raw
EX1203-D20120508-T221430.raw	EX1203-D20120508-T221430.raw	EX1203-D20120508-T230031.raw
EX1203-D20120509-T154901.raw	EX1203-D20120512-T231402.raw	EX1203-D20120514-T084132.raw
EX1203-D20120513-T150723.raw	EX1203-D20120515-T150635.raw	EX1203-D20120514-T222933.raw
EX1203-D20120515-T233411.raw	EX1203-D20120516-T162331.raw	EX1203-D20120517-T121827.raw
EX1203-D20120518-T004558.raw	EX1203-D20120518-T160531.raw	EX1203-D20120519-T065248.raw
EX1203-D20120519-T220007.raw	EX1203-D20120520-T060611.raw	EX1203-D20120520-T061227.raw
EX1203-D20120521-T165710.raw	EX1203-D20120521-T190153.raw	EX1203-D20120521-T210255.raw
EX1203-D20120521-T231259.raw	EX1203-D20120522-T071637.raw	EX1203-D20120522-T232102.raw
EX1203-D20120523-T112926.raw	EX1203-D20120523-T113107.raw	EX1203-D20120523-T113127.raw
EX1203-D20120523-T113337.raw	EX1203-D20120523-T113451.raw	EX1203-D20120523-T113501.raw
EX1203-D20120523-T134906.raw	EX1203-D20120523-T15460.raw	

List of Knudsen SBP files (SGY Files)

Name of SGY File	Date Collected	Name of SGY File	Date Collected
EX1203_SBP_70870_3.5kHz_014.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_015.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_016.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_017.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_018.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_019.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_020.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_021.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_022.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_023.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_024.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_025.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_026.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_027.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_028.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_029.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_030.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_031.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_032.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_033.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_034.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_035.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_036.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_037.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_038.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_039.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_040.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_041.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_042.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_043.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_044.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_045.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_046.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_047.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_048.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_049.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_050.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_051.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_052.sgy	05/06/2012	EX1203_SBP_70870_3.5kHz_053.sgy	05/06/2012
EX1203_SBP_70870_3.5kHz_054.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_055.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_056.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_057.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_058.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_059.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_060.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_061.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_062.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_063.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_064.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_065.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_066.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_067.sgy	05/07/2012
EX1203_SBP_70870_3.5kHz_068.sgy	05/07/2012	EX1203_SBP_70870_3.5kHz_069.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_070.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_071.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_072.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_073.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_074.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_075.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_076.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_077.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_078.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_079.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_080.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_081.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_082.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_083.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_084.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_085.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_086.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_087.sgy	05/08/2012

EX1203_SBP_70870_3.5kHz_088.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_089.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_090.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_091.sgy	05/08/2012
EX1203_SBP_70870_3.5kHz_092.sgy	05/08/2012	EX1203_SBP_70870_3.5kHz_093.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_094.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_095.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_096.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_097.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_098.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_099.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_100.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_101.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_102.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_103.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_104.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_105.sgy	05/09/2012
EX1203_SBP_70870_3.5kHz_106.sgy	05/09/2012	EX1203_SBP_70870_3.5kHz_107.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_108.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_109.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_110.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_111.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_112.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_113.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_114.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_115.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_116.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_117.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_118.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_119.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_120.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_121.sgy	05/10/2012
EX1203_SBP_70870_3.5kHz_122.sgy	05/10/2012	EX1203_SBP_70870_3.5kHz_123.sgy	05/11/2012
EX1203_SBP_70870_3.5kHz_124.sgy	05/11/2012	EX1203_SBP_70870_3.5kHz_125.sgy	05/11/2012
EX1203_SBP_70870_3.5kHz_126.sgy	05/11/2012	EX1203_SBP_70870_3.5kHz_127.sgy	05/11/2012
EX1203_SBP_70870_3.5kHz_128.sgy	05/11/2012	EX1203_SBP_70870_3.5kHz_129.sgy	05/11/2012
EX1203_SBP_70870_3.5kHz_130.sgy	05/11/2012	EX1203_SBP_70870_3.5kHz_135.sgy	05/11/2012
EX1203_SBP_70870_3.5kHz_136.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_137.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_138.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_139.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_140.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_141.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_142.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_143.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_144.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_145.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_146.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_147.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_148.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_149.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_150.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_151.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_152.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_153.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_154.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_155.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_156.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_157.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_158.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_159.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_160.sgy	05/12/2012	EX1203_SBP_70870_3.5kHz_161.sgy	05/12/2012
EX1203_SBP_70870_3.5kHz_162.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_163.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_164.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_165.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_166.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_167.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_168.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_169.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_170.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_171.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_172.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_173.sgy	05/13/2012

EX1203_SBP_70870_3.5kHz_174.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_175.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_176.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_177.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_178.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_179.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_180.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_181.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_182.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_183.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_184.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_185.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_186.sgy	05/13/2012	EX1203_SBP_70870_3.5kHz_187.sgy	05/13/2012
EX1203_SBP_70870_3.5kHz_187.sgy	05/14/2012	EX1203_SBP_70870_3.5kHz_188.sgy	05/14/2012
EX1203_SBP_70870_3.5kHz_189.sgy	05/14/2012	EX1203_SBP_70870_3.5kHz_190.sgy	05/14/2012
EX1203_SBP_70870_3.5kHz_191.sgy	05/14/2012	EX1203_SBP_70870_3.5kHz_192.sgy	05/14/2012
EX1203_SBP_70870_3.5kHz_003.sgy	05/15/2012	EX1203_SBP_70870_3.5kHz_004.sgy	05/15/2012
EX1203_SBP_70870_3.5kHz_005.sgy	05/15/2012	EX1203_SBP_70870_3.5kHz_006.sgy	05/15/2012
EX1203_SBP_70870_3.5kHz_007.sgy	05/15/2012	EX1203_SBP_70870_3.5kHz_008.sgy	05/15/2012
EX1203_SBP_70870_3.5kHz_009.sgy	05/15/2012	EX1203_SBP_70870_3.5kHz_010.sgy	05/15/2012
EX1203_SBP_70870_3.5kHz_011.sgy	05/15/2012	EX1203_SBP_70870_3.5kHz_012.sgy	05/15/2012
EX1203_SBP_70870_3.5kHz_013.sgy	05/15/2012	EX1203_SBP_70870_3.5kHz.sgy	05/15/2012
0007_2012_136_1547_70870_3.5kHz_015.sgy	05/15/2012	0008_2012_136_1548_70870_3.5kHz_016.sgy	05/15/2012
0008_2012_136_1620_70870_3.5kHz_017.sgy	05/15/2012	0008_2012_136_1652_70870_3.5kHz_018.sgy	05/15/2012
0008_2012_136_1725_70870_3.5kHz_019.sgy	05/15/2012	0008_2012_136_1756_70870_3.5kHz_020.sgy	05/15/2012
0008_2012_136_1828_70870_3.5kHz_021.sgy	05/15/2012	0008_2012_136_1921_70870_3.5kHz_022.sgy	05/15/2012
0008_2012_136_1955_70870_3.5kHz_023.sgy	05/15/2012	0008_2012_136_2026_70870_3.5kHz_024.sgy	05/15/2012
0008_2012_136_2058_70870_3.5kHz_025.sgy	05/15/2012	0008_2012_136_2131_70870_3.5kHz_026.sgy	05/15/2012
0008_2012_136_2204_70870_3.5kHz_027.sgy	05/15/2012	0008_2012_136_2236_70870_3.5kHz_028.sgy	05/15/2012
0008_2012_136_2307_70870_3.5kHz_029.sgy	05/15/2012	0009_2012_137_1212_70870_3.5kHz_030.sgy	05/16/2012
0009_2012_137_1249_70870_3.5kHz_031.sgy	05/16/2012	0009_2012_137_1320_70870_3.5kHz_032.sgy	05/16/2012
0009_2012_137_1351_70870_3.5kHz_033.sgy	05/16/2012	0009_2012_137_1429_70870_3.5kHz_034.sgy	05/16/2012
0009_2012_137_1510_70870_3.5kHz_035.sgy	05/16/2012	0009_2012_137_1547_70870_3.5kHz_036.sgy	05/16/2012
0009_2012_137_1618_70870_3.5kHz_037.sgy	05/16/2012	0009_2012_137_1650_70870_3.5kHz_038.sgy	05/16/2012
0009_2012_137_1728_70870_3.5kHz_039.sgy	05/16/2012	0009_2012_137_1813_70870_3.5kHz_040.sgy	05/16/2012
0009_2012_137_1901_70870_3.5kHz_041.sgy	05/16/2012	0009_2012_137_1948_70870_3.5kHz_042.sgy	05/16/2012
0009_2012_137_2034_70870_3.5kHz_043.sgy	05/16/2012	0009_2012_137_2122_70870_3.5kHz_044.sgy	05/16/2012
0009_2012_137_2211_70870_3.5kHz_045.sgy	05/16/2012	0009_2012_137_2308_70870_3.5kHz_046.sgy	05/16/2012
0009_2012_137_2357_70870_3.5kHz_047.sgy	05/16/2012	0010_2012_138_1201_70870_3.5kHz_048.sgy	05/17/2012
0010_2012_138_1237_70870_3.5kHz_049.sgy	05/17/2012	0010_2012_138_1309_70870_3.5kHz_050.sgy	05/17/2012
0010_2012_138_1342_70870_3.5kHz_051.sgy	05/17/2012	0010_2012_138_1420_70870_3.5kHz_052.sgy	05/17/2012
0010_2012_138_1504_70870_3.5kHz_053.sgy	05/17/2012	0010_2012_138_1551_70870_3.5kHz_054.sgy	05/17/2012
0010_2012_138_1639_70870_3.5kHz_055.sgy	05/17/2012	0010_2012_138_1727_70870_3.5kHz_056.sgy	05/17/2012
0010_2012_138_1812_70870_3.5kHz_057.sgy	05/17/2012	0010_2012_138_1958_70870_3.5kHz_058.sgy	05/17/2012
0010_2012_138_2038_70870_3.5kHz_059.sgy	05/17/2012	0010_2012_138_2112_70870_3.5kHz_060.sgy	05/17/2012
0010_2012_138_2144_70870_3.5kHz_061.sgy	05/17/2012	0010_2012_138_2218_70870_3.5kHz_062.sgy	05/17/2012
0010_2012_138_2255_70870_3.5kHz_063.sgy	05/17/2012	0010_2012_138_2339_70870_3.5kHz_064.sgy	05/18/2012

0011_2012_139_1216_70870_3.5kHz_065.sgy	05/18/2012	0011_2012_139_1248_70870_3.5kHz_066.sgy	05/18/2012
0011_2012_139_1321_70870_3.5kHz_067.sgy	05/18/2012	0011_2012_139_1353_70870_3.5kHz_068.sgy	05/18/2012
0011_2012_139_1428_70870_3.5kHz_069.sgy	05/18/2012	0011_2012_139_1503_70870_3.5kHz_070.sgy	05/18/2012
0011_2012_139_1536_70870_3.5kHz_071.sgy	05/18/2012	0011_2012_139_1607_70870_3.5kHz_072.sgy	05/18/2012
0011_2012_139_1634_70870_3.5kHz_073.sgy	05/18/2012	0011_2012_139_1702_70870_3.5kHz_074.sgy	05/18/2012
0011_2012_139_1730_70870_3.5kHz_075.sgy	05/18/2012	0011_2012_139_1758_70870_3.5kHz_076.sgy	05/18/2012
0011_2012_139_1827_70870_3.5kHz_077.sgy	05/18/2012	0011_2012_139_1856_70870_3.5kHz_078.sgy	05/18/2012
0011_2012_139_1928_70870_3.5kHz_079.sgy	05/18/2012	0011_2012_139_1958_70870_3.5kHz_080.sgy	05/18/2012
0011_2012_139_2028_70870_3.5kHz_081.sgy	05/18/2012	0011_2012_139_2054_70870_3.5kHz_082.sgy	05/18/2012
0011_2012_139_2123_70870_3.5kHz_083.sgy	05/18/2012	0011_2012_139_2153_70870_3.5kHz_084.sgy	05/18/2012
0011_2012_139_2219_70870_3.5kHz_085.sgy	05/18/2012	0011_2012_139_2245_70870_3.5kHz_086.sgy	05/18/2012
0011_2012_139_2311_70870_3.5kHz_087.sgy	05/18/2012	0011_2012_139_2338_70870_3.5kHz_088.sgy	05/19/2012
0011_2012_140_0006_70870_3.5kHz_089.sgy	05/19/2012	0012_2012_140_1209_70870_3.5kHz_090.sgy	05/19/2012
0012_2012_140_1304_70870_3.5kHz_091.sgy	05/19/2012	0012_2012_140_1359_70870_3.5kHz_092.sgy	05/19/2012
0012_2012_140_1455_70870_3.5kHz_093.sgy	05/19/2012		

List of Knudsen SBP files (KEB Files)

Name of KEB file	Date Collected
EX1203_SBP_000.keb	05/10/2012
EX1203_SBP_001.keb	05/10/2012
EX1203_SBP_001.keb	05/11/2012
EX1203_SBP_002.keb	05/11/2012
EX1203_SBP_003.keb	05/14/2012
EX1203_SBP_004.keb	05/15/2012
EX1203_SBP_005.keb	05/15/2012
EX1203_SBP_006.keb	05/15/2012
EX1203_SBP.keb	05/15/2012
EX1203_SBP_007.keb	05/15/2012
0007_2012_136_1547_007.keb	05/15/2012
0008_2012_136_1548_007.keb	05/15/2012
0009_2012_137_1212_008.keb	05/16/2012
0010_2012_138_1201_009.keb	05/18/2012
0011_2012_139_1216_010.keb	05/19/2012
0012_2012_140_1209_011.keb	05/19/2012

Appendix B: EM302 description and operational specs

EM 302 : Ideal for Ocean Exploration
There are several features of the *Okeanos Explorer's* 30 kHz multibeam that make it an excellent tool for ocean exploration. The following is a brief description of these features.

Depth Range
The system is designed to map the seafloor in water depths of 10 to 7000 meters. This leaves only the deepest parts of the deeper ocean trenches out of the EM 302's reach. Moreover, operational experience on the *Okeanos Explorer* has shown consistent EM 302 bottom detection at depth ranges in excess of 8000m. The optimal depth for EM 302 has been found to be > 150 m.

High Density Data
In multibeam data, the denser the data, the finer resolution maps you can produce. The system can operate in dual swath, or multi-ping mode, which results in increased along track data density. This is achieved by detecting two swaths per ping cycle, resulting in up to 864 beams per ping.

The *Okeanos Explorer* mapping team typically operates the multibeam in high density equidistant ping mode, which results in up to 864 soundings on the seafloor per ping.

Full Suite of Data Types Collected
The system collects seafloor backscatter data, which provides information about the character of the seafloor in terms of bottom type.

The system also collects water column backscatter data, which has the ability to detect gaseous plumes in the water column. The full value of this feature is still being realized.

FM chirp mode is utilized in water depths greater than 1000 meters, and allows for the detection of the bottom further out from nadir than with previous 30 kHz systems.

Multibeam Primer
The area of the seafloor covered, or ensonified, by a single beam within a pulse of sound, or ping, is called the beam footprint. This beam footprint is defined in terms of the across track and along track values. Both of these values are dependent on water depth and the beam width at which the sound pulse is transmitted and received. The across track beam width value is also dependent on the receive angle, or "listening" angle, of the system, and the angle from nadir which it is received from. The receive angle for the receive transducer on the *Okeanos Explorer* EM302 is 1°, which is the smallest possible angle currently available for the EM302 system. The further out from nadir a sounding occurs, the larger the footprint will be. For example, as seen in Table 1 below, in 2000 meters of water, a beam footprint will have a radius of 18 meters at nadir but 25 meters by the time it hits the seafloor at an angle 140 degrees out from nadir.

Calculated acrosstrack acoustic beam footprint for EM 302 (high density ping mode, 432 soundings/profile)				
Water depth (m)	**Angle from nadir**			
50	1 deg RX center	90 deg	120 deg	140 deg
100	1	0.5	1	1
200	2	1	2	3
400	4	2	3	5
1000	7	4	6	10
2000	18	9	16	25
4000	35	19	32	-
6000	70	37	-	-
7000	105	56	-	-

Table 1. Calculated across track EM 302 beam footprint. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 17.

Calculated acrosstrack sounding density for EM 302 (high density ping mode, 432 soundings/profile)			
Water depth (m)	**Swath Width**		
50	90 deg	120 deg	140 deg
100	0.2	0.4	0.9
200	0.5	0.8	1.7
400	0.9	1.6	3.5
1000	1.9	3.2	6.9
2000	4.6	8.1	17.4
4000	9.3	16.2	-

Table 2. Calculated across track EM 302 sounding density. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 17.

Acrosstrack sounding density describes the spacing between individual soundings on the seafloor in the acrosstrack direction. The maximum swath of the EM 302 is 150 degrees. At this swath, the sounding density will be the least dense, since the beams will be spread out over a larger horizontal distance over the seafloor. As the swath angle (width) is decreased, the sounding density will increase, as the same number of beams are now spread out over a smaller horizontal distance over the seafloor.

Calculated ping rate and alongtrack resolution for EM 302					
140 deg swath, one profile per ping					
			Alongtrack distance between profiles (m)		
Water depth (m)	**Swath Width (m)**	**Ping Rate (pings/second)**	**@4 kts**	**@8 kts**	**@12 kts**
50	275	3.2	0.7	1.2	1.9
100	550	1.8	1.1	2.2	3.3
200	1100	1	2.1	4.2	6.3
400	2200	0.5	4.1	8.2	12.2
1000	5500	0.2	10	20	30
2000	8000	0.1	15.2	30.5	45.7
4000	8000	0.06	19.2	38.5	57.7
6000	8000	0.04	24.5	49	73.4

Table 3. Calculated ping rate and along track EM 302 sounding density, one profile per ping. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 15.

Calculated ping rate and alongtrack resolution for EM 302					
140 deg swath, two profiles per ping					
			Alongtrack distance between profiles (m)		
Water depth (m)	**Swath Width (m)**	**Ping Rate**	**@4 kts**	**@8 kts**	**@12 kts**
50	275	3.2	0.3	0.6	0.9
100	550	1.8	0.6	1.1	1.7
200	1100	1	1.1	2.1	3.2
400	2200	0.5	2	4.1	6.1
1000	5500	0.2	5	10	15
2000	8000	0.1	7.6	15.2	22.8

Table 4. Calculated ping rate and along track EM 302 sounding density, two profiles per ping. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 15.

Reference: Kongsberg Product Description: EM 302 multibeam echosounder.

Appendix C: Acronyms and abbreviations

BOEM: Bureau of Ocean Energy Management
CCOM: Center for Coastal and Ocean Mapping (UNH)
CTD: Conductivity, Temperature, Depth
EEZ: Exclusive Economic Zone
ERT Inc: Earth Resources Technologies, Inc
GSO: Graduate School of Oceanography (URI)
JHC: Joint Hydrographic Center (UNH)
MBES: Multibeam Echo Sounder
NCDDC: National Coastal Data Development Center
NGDC: National Geophysical Data Center
NOAA: National Oceanic and Atmospheric Administration
OER: Office of Ocean Exploration and Research
OMAO: Office of Marine and Aviation Operations
SCS: Shipboard Computer System
SOP: Standard Operating Procedure
SST: Senior Survey Technician
ST: Survey Technician
UCAR: University Corporation for Atmospheric Research
UNH: University of New Hampshire
URI: University of Rhode Island
USGS: United States Geological Survey
XBT: Expendable Bathy Thermograph
CSIRO: The Commonwealth Scientific and Industrial Research Organisation

Appendix D: May 24, 2012 Event attendees list

Virginia Coastal Zone MANAGEMENT PROGRAM

Sea Grant Virginia

Okeanos Explorer Expedition of Mid-Atlantic Canyons:

Leveraging NOAA & State Capacity to Meet Ocean Habitat & Planning Interests

ATTENDEES LIST

Jim Armstrong, Mid-Atlantic Fishery Management Council
William Boll, Old Dominion University, Student Intern on the Okeanos cruise
Po Chi Fung, NOAA OAR Congressional Analysis and Relations Division
Rear Admiral Michael Devany, NOAA Marine & Aviation Operations
Kathryn Greves, Virginia Sea Grant, Communication
Chet Grosch, Old Dominion University, Center for Coastal Physical Oceanography
Troy Hartley, Virginia Sea Grant, Director
Rodger Harvey, Old Dominion University, Dept Ocean, Earth, and Atmospheric Science, Chair
Todd Janeski, Virginia Commonwealth University & VA Dept of Conservation and Recreation
CDR Robert Kamphaus, NOAA Ship Okeanos Explorer, Commanding Officer
Janet Krenn, Virginia Sea Grant, Communication
Andrew Larkin, NOAA Fisheries, Chesapeake Bay Office
Mashkoor Malik, NOAA OAR Office of Ocean Exploration and Research, Physical Scientist
Laura McKay, Virginia Coastal Zone Management Program, Manager, and MARCO
LT Megan Nadeau, NOAA Ship Okeanos Explorer, Operations Officer
Martha Nizinski, NOAA NMFS Northeast Fisheries Science Center, Zoologist
Jay O'Dell, The Nature Conservancy, MARCO Portal Leader
Brian Pawlak, Acting Director, NOAA Fisheries, Office of Habitat Conservation
Jeremy Potter, NOAA OAR Office of Ocean Exploration and Research, Expeditions Coordinator
Willy Reay, VIMS, Chesapeake Bay National Estuarine Research Reserve
Craig Russell, NOAA OAR Office of Ocean Exploration and Research, Okeanos Explorer Program Manager
Eric Schwaab, Acting Deputy Administrator NOAA
Rick Weeks, Deputy Director, VA Dept of Environmental Quality
John Wells, Virginia Institute of Marine Science (VIMS), Dean & Director
Virginia Witmer, Virginia Coastal Zone Management Program, Communication